

The MODEL ENGINEER and Light Machinery Review

66 Farringdon St.
London EC4
Founded 1898

4^d

A Journal of
Small Power
Engineering

Vol. 60. No. 1448.

THURSDAY, FEBRUARY 7, 1929.

Post Free 5d.

Models

we make
STEAM ENGINES,
LOCOMOTIVES—
MARINE
TURBINES,
HORIZONTAL,
VERTICAL,
RAILWAY
ENGINE PARTS,
BOILERS,
BOILER FITTINGS,
CASTINGS,
MATERIALS.

We make and supply
everything for making
and fitting Models.

SEND FOR OUR LARGE COPYRIGHT CATALOGUE, 900 illustrations,
BY POST 8d. to any part of the World; you will then see what we
make and sell, and what we can do for you in Model Making.

STEVENS'S MODEL DOCKYARD, LONDON, E.1.
Price List of Engines (Boilers or Ships), Castings and Materials,
by Post 3d. each List.

Models

everything for
SAILING YACHTS,
RACING CUTTERS,
SCHOONERS, &c.
STEAMBOATS,
ELECTRIC BOATS,
TORPEDO-BOAT
DESTROYERS,
WARSHIPS,
SHIPS' FITTINGS,
DYNAMOS, MOTORS.
ELECTRIC FITTINGS.
MODELS FOR
INVENTORS.
ENGLISH MADE
in our own Workshops.
Immense Stock.

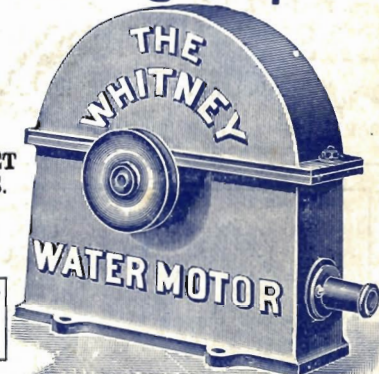
There is NO Cheaper Way
of Obtaining $\frac{1}{4}$ h.p.

45/-
free on rail.

HEIGHT 11 $\frac{1}{2}$ "
WEIGHT 32lb.
BASE 11 $\frac{1}{2}$ " x 3 $\frac{1}{2}$ "

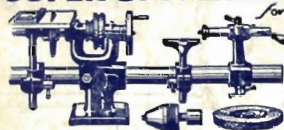
COMPLETE SET
OF CASTINGS.
with Shaft, and
anti-friction meta.
25/- f.o.r.

ESTABLISHED
50 YEARS.
Telephone:
CLERKENWELL 244



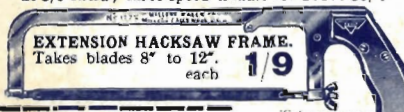
WHITNEY, 129/131, City Rd., LONDON, E.C.1.

SUPER UNIVERSAL LATHE



POLISHING
GRINDING
DRILLING
SAWING
MILLING
& TURNING

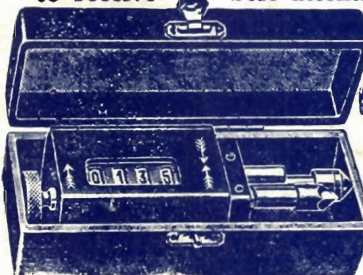
Height of spindle 5 $\frac{1}{2}$ ", pulley 2 $\frac{1}{2}$ " x 1" face, diam. of spindle 1", belting suitable 1" round, length of spindle 8 $\frac{1}{2}$ ", diam. of bar bed 15/16", length of bar bed, 18", abrasive wheel taken, 6" x 1", swings in diameter 4", drill chuck 0 to 1", approx. weight 17 lb. Price complete as above, but with ordinary tailstock ... **36/-**
If without saw table attachment 22/-; lever feed tailstock, as illustrated, can be fitted to either of above at 5/6 extra; three-speed treadle for above 30/-.



EXTENSION HACKSAW FRAME.
Takes blades 8" to 12".
each **1/9**
Catalogue of Special Offers
Free and Post Free.
Complete Catalogue (275 pages)
fully illustrated, post free 2/-.
Amount paid may be deducted
from your first order of 10/-.

Telephones:
Clerkenwell
4004 and 4005
Telegrams:
"Tyzzar, Finsquare,
London."

We welcome every inquiry.
Nothing too large or too small
to receive best attention.



REVOLUTION COUNTERS. Register up to 10,000.
Can be used for speeds up to 5,000 revs. per
minute. Can be used for left or right
hand revolution ... each **7/-**

S. TYZACK & SON, LTD.
TOOL SPECIALISTS,
341, 343 and 345, Old Street, LONDON, E.C.1.

No. 2
M.F. PATTERN
HAND DRILL.

Capacity
of 3-jaw
self-centring
chuck
0 to 1"

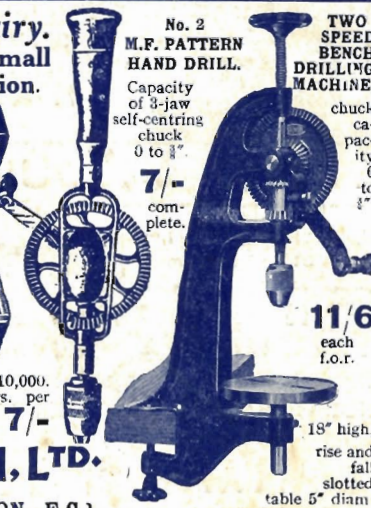
7/-
com-
plete.

TWO
SPEED
BENCH
DRILLING
MACHINE.

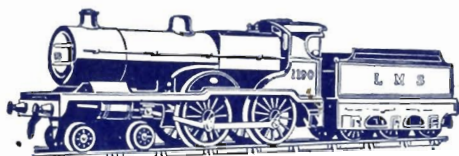
chuck
ca-
pac-
ity
0
to
1"

11/6
each
f.o.r.

18" high,
rise and
fall
slotted
table 5" diam



Masterpieces in Miniature



New 4-4-0 L.M.S. Locomotive in Clockwork
1 1/2" Gauge 3/6

BASSETT-LOWKE SCALE MODELS have set the fashion for the past twenty-five years, and are unequalled for Design, Workmanship and Finish. They are the "real" thing in miniature. Perfectly made; exquisite in finish; scientific in design.

Locomotives, rails, carriages, wagons, stations, bridges, signals and all model railway sundries. Yachts, steam boats, ship's fittings and parts, and accessories for Model Boat Builders.

Steam engines and boilers, fittings, castings, materials and designs; everything, in fact, for the model or experimental engineer is illustrated and described in our CATALOGUES.

CATALOGUE SECTION—A/16. Devoted entirely to Model Railways and their equipment. Over 132 pages. Post free 6d.

CATALOGUE SECTION—B 16. Describing complete Stationary Engines. Boilers, Boiler and Engine Fittings and Parts. Post free 1/-.

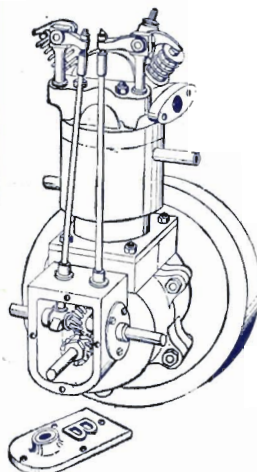
CATALOGUE SECTION 516. Model Sailing Yachts, Racing Motor Boats, Ships' Fittings and accessories. Post free 6d.

BASSETT-LOWKE, LTD.
NORTHAMPTON.

London: 112, High Holborn, W.C.1. Manchester Branch: 28, Corporation St. Edinburgh: 5, Frederick St.

The "BONZONE" 1929 Model PETROL ENGINE

For SPEED MOTOR BOATS, DYNAMO DRIVING, Etc.
incorporating all that is New in Racing Engine Design.



Weight complete approx. 6 lb., with 5" flywheel. Speed 5,000 to 6,000 r.p.m. Bore 1 1/4" x stroke 1 1/4".

Supplied only as a SET OF CASTINGS.

Dome top piston, overhead mechanical inlet and exhaust valve, built-up crankshaft in 3% nickel steel, hollow steel connecting rod, water-cooled cylinder.

Write for Special Descriptive Leaflet.

Price of Set of Castings, with all Screws, Nuts, three Rings, Springs, and Cut Gears, with a complete and clear drawing,

£2:15:0

Post Paid in U.K.

Bonds' 1929 102 page Model List now ready, **4d.**

BONDS' o' Euston Rd., Ltd.
254, Euston Rd., LONDON, N.W.1.

'Phone: MUSEUM 7137.



FOR SOLDERING

USE — STOCK — SELL

"BAKER'S PREPARATION"

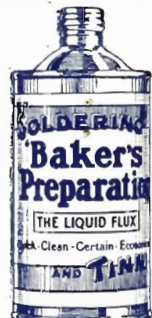
The Liquid Flux

Instant action—Requires no skill— Does not splutter—Tins and cleans the iron

SOLD IN 6° 1/- 1/6 2/- TINS AND BULK.

SOLE MANUFACTURERS.
SIR WILLIAM BURNETT & Co., Millwall, London E.14.

OBTAINABLE FROM IRONMONGERS, CYCLE AND MOTOR STORES.



One man can do the work of three!

A NEW LABOUR AND TEMPER SAVING TOOL

5 INCH or 7 INCH SPINDLE, Same Price 1/6

THE "NIPSIT" ASSEMBLED



HOLDING SCREW READY FOR INSERTING IN AWKWARD PLACE OR POSITION INACCESSIBLE TO THE FINGERS

THE "NIPSIT" SCREW POSITIONER AND REVERSIBLE SCREWDRIVER.

Holds Small Screws for Inserting in Awkward Places or Positions Inaccessible to the Fingers. INDISPENSABLE to MODEL ENGINEERS, WIRELESS BUILDERS, HOBBY WORKERS, ELECTRICIANS.

TO BE HAD FROM IRONMONGERS—HARDWARE AND WIRELESS DEALERS—STORES, Etc.,

OR FOR P.O. 1/6, FROM THE MAKERS, R. E. COLLINGWOOD & SON, LTD., ROCHDALE.

GAMAGES

Scale Model Rustless Steel Track

The "Gamage" Scale Model Permanent Way is made of Rustless Steel and is the finest and most realistic Track on the market.



CURVES. Gauge 0. 12 to circle of 4 ft. diam. ... per length 1/3
Ditto. Gauge 1. 16 to circle of 8 ft. diam. ... per length 1/6
Post 6d. dozen.

Gauge 0. **BRAKE RAILS** ... Each 3/9
Gauge 1. ... 4/3
RAIL only, "in lengths of 3 ft. doz. lengths 5/-

CHAIRS, spring steel ... per 100 2/-
SLIP CHAIRS, fitted with brass angle plates ... per doz. 1/9
CHECK RAIL CHAIRS, spring steel ... per doz. 9d.

(The last two are for use only on Points.)

CAST CHECK RAIL CHAIRS, per doz. 1/6

Gauge 0. **SLEEPERS** ... per 100 3/-

Gauge 1. ... per 100 3/3

BATTENS, in 3-ft. lengths ... per pair 4d.

HOLDING-DOWN SPIKES, per packet 3d.

FISH PLATES ... per doz. 8d.

Chairs and Fish Plates are of Oxidised Spring Steel. Sleepers and Battens are made from selected and seasoned Wood of the same thickness and width throughout.



SWITCHES, with lever, as used on the L.M.S. to-day.
Gauge 0. each 11/6 Gauge 1. each 12/6
Right or left Post 9d. doz.



CROSSINGS.

Gauge 0 ... each 7/6 Gauge 1 ... each 8/6
Post 4d.



Gauge 0. **Straight, 12" long** ... per length 1/3
Gauge 1. **Straight, 12" long** ... per length 1/6
Post 9d. doz.

The "GAMAGE" RUSTLESS STEEL RAIL

for Electric Railways.

Gauge 0. **Straight and Curved Electric Rails** ... per length 1/6
Gauge 1. Ditto ... 2/3

Gauge 0. **Switches** ... 13/6

Gauge 1. ... 14/6

Gauge 0. **Crossings** ... 12/6

Gauge 1. ... 13/6

Gauge 0. **Terminal Rail** ... 3/9

Gauge 1. ... 4/3

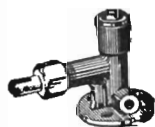
Postage extra under 20/-.

City Branch:

107, CHEAPSIDE, E.C.2.

A. W. GAMAGE, LTD., HOLBORN, LONDON, E.C.1.

STEAM FITTINGS.



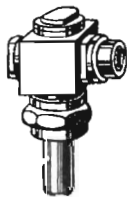
FORCE PUMPS,
3/6 ea.



UNIONS,
9d. ea.



HAND PUMPS,
5/3 ea.



CHECK VALVES, LUBRICATORS,
2/- ea.



DISPLACEMENT LUBRICATORS,
3/- ea.



PRESSURE GAUGES,
6/11 ea.

Full Details in our New 20 Page Catalogue, 2d. Post Free. Over 60 Fittings and Accessories.

F. YATES & SON, LTD.,
144, Church Street, Kensington, W.8.

GRADUAL PAYMENT

on all Wireless and Gramophone Goods

Why wait—take advantage of our scheme of gradual payments. You can have gramophone or wireless goods to the value of £5 or over without financial worry or embarrassment.

AN EXAMPLE.

£5 worth of goods supplied on DEPOSIT OF 20/- and 9/- per month for 10 months.

COSSOR MELODY KITS.

£7:15:0 Cash, or 31/- deposit and 12/5 per month for 10 months.

MAGNAVOX

MOVING-COIL SPEAKER.

£8:5:0 Cash, or 33/- deposit and 13/5 per month for 10 months.

ANY GRAMOPHONE, WIRELESS SET, SPEAKER, RECORDS OR COMPONENTS SUPPLIED ON THE SAME TERMS.

Please write for full details.

For the Best in Radio

WILL DAY LTD.

(THE BEST IN THE WEST)

19 LISLE STREET, LEICESTER SQUARE, LONDON, W.C.2. ↑

Phone: (4 lines) Regent 0921 and 0122 Telegrams: Willday, London

No Firm in Great Britain can Beat Us.
MAKE YOUR OWN GRAMOPHONES.
 We supply Engineers at wholesale prices. Our 64-pp. illus. cat., with scale drawing, tells you for 3d. how to make Gramophones, what accessories to choose. Buy the N.216 set, guaranteed three-record motor, double spring, 12" turntable, swan-neck tone-arm, aluminium sound-box, internal shaped horn and needle cups, for 38/6, post free. Machines sold by other firms at 1/5 do not contain better fittings. Other sets from 18/6; Motors, 30 sizes, with 1, 2, 3 or 4 main springs, also Electric Motors, from 8/-; Tone-arms, 3/6; Sound-boxes, 2/-; Springs, Needles, Horns, Lid-stays, Hinges, Knobs, Violins, Accordions, Mandolines, Gramophones from 18/6; Cabinets 6/-. **THE REGENT FITTINGS Co.,** 68d, 120, Old Street, LONDON, E.C.1.
 Established 24 years.



Accordions, Mandolines, Gramophones from 18/6; Cabinets 6/-. **THE REGENT FITTINGS Co.,** 68d, 120, Old Street, LONDON, E.C.1.
 Established 24 years.

FROST & CO.,

70, Old Compton St., London, W.1.

Engineers, Tool and Model Makers,
ACCURATE WORK. QUICK DELIVERY.

All small repair work undertaken.
 Patterns, Castings, or Finished Parts, Small Stampings, and Press Tools.

EXPERIMENTAL AND REPETITION WORK.

Complete Set with
 full instructions

PRICE **7/6**

The lamp alone, 2/6.



ANOTHER USE FOR

FLUXITE

(the paste that simplifies soldering)

**HARDENING TOOLS
 and CASE-HARDENING**

Ask for Leaflet on improved methods.

Of all Ironmongers, in Tins, 8d., 1/4, and 2/8.

FLUXITE LTD. (Dept. 79), West Lane Works,
 Rotherhithe, London, S.E.16.

"TINKERING"

makes dirty, oily, greasy hands,
 but they'll come clean in next
 to no time with

CALVERT'S Pumice Soap

If you find any difficulty in
 obtaining locally send 3d. for full
 size sample tablet to makers.

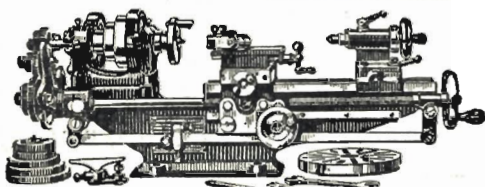
F. C. CALVERT & CO., (Dept. 7),
 P.O. Box 147, MANCHESTER.



DRAWING INSTRUMENTS.

FINEST QUALITY AND FINISH.

A. G. THORNTON, Ltd., Manufacturers,
 Contractors to the British and other Governments,
**PARAGON WORKS, 6, KING ST. WEST,
 MANCHESTER.**



DRUMMOND LATHES by Instalments.

You can get the finest lathe with complete equipment, chucks, tools, special attachments—by the hire-purchase system if you so desire. Write for full particulars and illustrated lists—

DRUMMOND BROS., Ltd., Rise Hill, Guildford.

SALES AND WANTS

EVERYBODY'S MARKET

ENGINEERING ELECTRICAL & SCIENTIFIC GOODS

THE RATE is 1d. per word throughout. Minimum charge One Shilling.

The CLASSIFICATIONS are:

General, Models, Wireless, Motoring, Tools, Engines, Electrical, Business, Wanted.

(Please put a ring round section applicable to this advt.)

1/-

1/6

2/-

2/6

3/-

ALL ADVERTISEMENTS MUST BE PREPAID.

Name and address are charged for, and compound words count as two words. Box Nos. are charged 6d. extra for postage, and must conclude as follows: "Box —, MODEL ENGINEER" Offices—these words are charged at the usual rate.

PLEASE WRITE IN INK.

USE THIS FORM and post (not later than Thursday for following week's issue) with remittance to cover cost to The Advt. Manager

"The Model Engineer."

66, Farringdon Street, London, E.C.4.

A supply of "Smalls" forms will be sent post free upon application.

Parts to make this Wonderful GRAMOPHONE (with life-like tone) 42-; carr. paid U.K. Working Drawings and list of Motors, 3d.



Splendid Bargains in TROUSER PRESSER AND STRETCHER FITTINGS. Nickel-plated Sets, 1 1/2" Bars, 3" Fly-Nuts (14") 7.9 per Set.

Two Sets, 14-; Seven days' approval; deposit. Carr. paid U.K. Working Drawings of eight types, 3d. Buy direct from Maker:-
R. E. GRAY,
29, Burnmaster Road, LONDON, S.W.17.

Don't forget to read the "Sales and Wants" advts. in this issue!

PORTASS 2 1/8" Gen. LATHES.

Defered Payments 5% extra. 55/- With lever tailstock 45/- 6/- WITH ORDER. 9 Monthly Payments.



WRITE DEPT. M.E.,
H. GREGORY,
14, Mount Pleasant Rd.,
SHEFFIELD.

Twelve Shillings

will secure one of these spaces (1" x 2") for you and will give world-wide publicity for your goods or service. TRY ONE IN THE NEXT ISSUE!

Lower rate for 13 or more insertions.

REDUCTION GEARS & UNITS.

ALL RATIOS & POWERS TO 1/10. OUR GEARS ARE USED BY THE L.C.C.



BALL THRUST. GUNMETAL BOX.

£1 EACH POST FREE.

A. J. BROWN & Co., ENGINEERS.
Phone: Clerkenwell, 3812. 32 NORTHAMPTON SQUARE, E.C1

Early Volumes of "The Model Engineer"

The publishers have pleasure in advising new readers of the M.E. that a few bound copies of the earlier volumes are still available, particulars of which are given below:-

Vols. V and VI, price 4.6 per volume (July, 1901-June, 1902) post free.

Vols. IX to XXI, XXIII, and XXV to XXXVIII; price 8.3 per volume. post free.

Vols. XXXIX to XLI; price 9.9 per volume (July, 1918-Dec., 1919) post free.

Vols. 42 to 59 (Jan., 1920-Dec., 1928), price 11/9 per volume, post free.

Please send your remittance to:-

PERCIVAL MARSHALL & CO.
66, Farringdon Street,
LONDON, E.C.4.



TREBLE-DUTY TERMINALS

have multiple uses and cost from 2d. to 4 1/2d. each, according to size and finish.

4 1/2d. TERMINAL T2LC as illustrated, nickel-plated, with choice of 40 indicating tops.

3d. TERMINAL T2LN as T2LC without indicating tops with slightly smaller head.

2 1/2d. TERMINAL T2SN as T2LN except smaller in size.

SPADES, PINS & EYES

For use with EELIX Treble-Duty Terminals



The above illustration shows a T14 Plug in parts. They are available in six coloured sleeves - red, yellow, black, blue, white or green-3d. each. Sockets 1d. each Name Plates 1d. each.

Write for Booklet A72 and learn all about the EELIX standard system of connections.

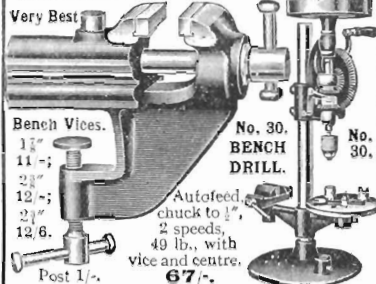


Eelox Works
118, Bunhill Row, London, E.C.1

'Phone: Clerkenwell 9282-3-4.

GEORGE ADAMS

292 & 293 HIGH HOLBORN LONDON



Bench Vices.

1 1/2" 11/-
2" 12/-
2 1/2" 12/-
3" 12.6.

No. 30. BENCH DRILL.

Autofeed, chuck to 1 1/2", 2 speeds, 49 lb., with vice and centre. 67/-.

DYNAMO MAGNETO

Repairs and Rewinds. Armature Winding. Terms to Trade.

Write for latest data sheet and price list, also monthly list of second-hand motors, etc.

MAGSTARLITE, LTD.,
325-325a, King Street, HAMMERSMITH, W.6.

'Phone: RIVERVIEW 0938.

OLDHAM BATTERY SERVICE.

PORTASS

2 1/2" Model B. Lathe,

as illus., £2:15:0

2 1/2" Model - de - Luxe,

Lathe ... £4:5:0

3" Back geared, Sliding, Self-acting, Screwcutting, Lathe, with iron stand, 3-speed wheel, chip trav ... £12:12:0

Write First Instance: HEELEY MOTOR and MANUFACTURING Co., Broadfield Rd., Sheffield. Deferred Terms through J. G. GRAVES, Sheffield.

YOU CAN BUILD A £40 GRAMOPHONE WITH OUR SALE DRAWINGS FOR 40/-

Book of instructions
3d. Catalogue of Motors,
Tonearms, Soundboxes, and
later internal Amplifiers free.

M.E.C., 386, York Road, LONDON, S.W.18.

QUERIES & REPLIES.

(1) Every query must be accompanied by a coupon from the current issue, and should be addressed "Query Department," The Model Engineer, 63, Farringdon Street, London, E.C.4.

(2) Short queries of a general character within the scope of the paper are replied to free of charge, provided a stamped addressed envelope is enclosed.

(3) Queries of a technical character are not replied to by post, except by special arrangement. They will be dealt with in turn either by a short explanatory article in an early issue, or will be published as letters inviting a helpful response from other readers.

(4) Where technical information by post is specially desired a charge will be made. The query will be handed over to a selected expert on the subject, who will quote his fee for the service required direct to the querist. A stamped addressed envelope must be enclosed in all such cases.

"The Model Engineer" Queries & Replies Coupon

To be cut out and enclosed with each Query sent in during the week commencing:

February 7, 1929.

Read the Rules before posting your Query.

MODERN TECHNICAL BOOKS

A Guide to the Latest Works by the Best Authors

Addresses of Publishers whose Books are included in this Guide:

G. BELL & SONS, LTD.,
York House, Portugal Street,
London, W.C.2.

BENTLEY PUBLISHING CO.,
Crossley Street,
Halifax, Yorks.

ELECTRICAL PRESS, LTD.,
13-16, Fisher Street,
Southampton Row, London, W.C.1.

GEORGE G. HARRAP & CO., LTD.,
39-41, Parker Street,
Kingsway, London, W.C.1.

LOCOMOTIVE PUBLISHING CO., LTD.,
3, Amen Corner,
London, E.C.4.

PERCIVAL MARSHALL & CO.
66, Farringdon Street,
London, E.C.4.

OXFORD UNIVERSITY PRESS,
Amen House, Warwick Square,
London, E.C.4.

SIR ISAAC PITMAN & SONS, LTD.,
39-41, Parker Street,
Kingsway, London, W.C.1.

RELIGIOUS TRACT SOCIETY,
4, Bouvier's Street,
London, E.C.4.

TELEVISTON PRESS, LTD.,
26, Charing Cross Road,
London, W.C.2.

Readers may obtain a complete list of books from the respective publishers upon mentioning "The Model Engineer"; book lists are sent post free.

Aviation.

"The Conquest of the Air." An Historical Survey. By C. L. M. Brown, Assistant, R.A.F. College. Cloth. Eight illustrations. A brief history of the developments of aeronautics up to 1914. 2s. 6d. net.—OXFORD UNIVERSITY PRESS.

Chemistry.

"A Course of Volumetric Work." By E. Clark, B.Sc. For day and evening students of Applied Chemistry, and also for Works Chemistry. Cloth, 152 pp., 4s. 6d. net.—SIR ISAAC PITMAN & SONS, LTD.

Drawing Office.

"Sketches of Engine and Machine Details." Contains 250 detail drawings (fully dimensioned). Handsomely bound. Post free 4s. (abroad 4s. 3d.).—BENTLEY'S PUBLISHING CO. (Dept. M.E.), Halifax.

"Technical Drawing." By C. E. Draycott, Wh. Exh., A.M.I.Mech.E., Head of Mechanical Engineering Dept., Borough Polytechnic, London. Crown 8vo. Cloth. An introduction to drawing for trade students. 6s. net.—OXFORD UNIVERSITY PRESS.

Electrical.

"Electricity for Everybody." R. Horlase Matthews, A.M.Inst.C.E., M.I.E.E. Third edition revised of a practical handbook on the uses of electricity. With numerous illustrations, diagrams and valuable tables. 260 pp. Crown 8vo. 7s. 6d. net, postage 6d.—ELECTRICAL PRESS, LTD.

"Elementary Electrical Technology." By A. M. Parkinson, B.Sc. (Eng'g) Lond., A.M.I.E.E. Crown 8vo. Cloth. 6s. net.—OXFORD UNIVERSITY PRESS.

"Practical Primary Cells." By A. Mortimer Codd, F.Ph.S. Gives working details of those cells having the greatest practical value, both for the laboratory and for commercial purposes. Cloth, 5s. net.—SIR ISAAC PITMAN & SONS, LTD.

"The Electrolytic Rectifier." By N. A. De Bruyne. For electrical engineers, physicists, and wireless amateurs. Cloth gilt, 80 pp., 3s. 6d. net.—SIR ISAAC PITMAN & SONS, LTD.

"Private House Electric Lighting." By F. H. Taylor, A.M.I.E.E. Describes modern methods in wiring and fitting, including a chapter on small generating plants. Price 1s. 6d.; post free 1s. 8d.—PERCIVAL MARSHALL & CO.

"Practical Dynamo and Motor Construction." By A. W. Marshall, A.M.I.E.E. A handbook of constructive details and workshop methods used in building small machines. Price 1s. 6d.; post free 1s. 8d.—PERCIVAL MARSHALL & CO.

"Electrical Apparatus Making." By A. V. Ballhatchet. A splendid book for the home or school workshop, showing how to construct a useful set of apparatus for experimental and educational purposes; fully illustrated with drawings and photographs. Price 3s.; post free 3s. 2d.—PERCIVAL MARSHALL & CO.

"More Electrical Apparatus Making." By A. V. Ballhatchet. A companion volume to "Electrical Apparatus Making." Further examples of experimental apparatus, some of a slightly advanced nature. Fully illustrated. Price 3s.; post free 3s. 2d.—PERCIVAL MARSHALL & CO.

"The A.B.C. of Dynamo Design." By A. H. Avery, A.I.E.E. Clearly explains the principles of a dynamo and how to calculate sizes and windings of machines; with numerous designs and 70 illustrations. Price 3s.; post free 3s. 2d.—PERCIVAL MARSHALL & CO.

"Maintenance and Repair of Electrical Measuring Instruments." By H. G. Yarrell. Explains the principles of operation of all types of instruments. Well illustrated. Price 2s. 6d.; post free 2s. 8d.—PERCIVAL MARSHALL & CO.

Engines.

"Engines." By E. N. da C. Andrade. "An ideal book for the amateur engineer. I know of no better or more easily followed explanation of the basic principles of engine design and operation," said THE MODEL ENGINEER in describing this book. All types are described and illustrated. 7s. 6d. net.—Write for illustrated prospectus to G. BELL & SONS.

"British Oil Engines." By W. A. Tooke, M.I.Mech.E. A practical guide to the choice, installation and management of modern heavy oil and paraffin engines. Tables of tests are of considerable value to designers and students. 176 pages; 23 illustrations. Price 2s. 6d.; post free 2s. 9d.—PERCIVAL MARSHALL & CO.

Machinery.

"The Book of Remarkable Machinery." By Ellison Hawks, Editor of "The Meccano Magazine." 7s. 6d. net. "A popular exposition of the steam engine, the marine engine, the internal combustion engine, and machinery used in iron and steel production, in printing and in various industrial operations. Very fully illustrated and well produced. Will make an excellent gift book for the younger generation and pleasant reading for grown-ups who take an intelligent interest in machinery" (Model Engineer).—HARRAP.

Mathematics.

"Definitions and Formulæ for Students—Practical Mathematics." By Louis Toft, M.Sc. Provides the student with all necessary definitions and formulæ in a convenient form. Pocket size, 6d. net.—SIR ISAAC PITMAN & SONS, LTD.

"Engineering Mathematics Simply Explained." By H. H. Harrison. A splendid text-book for apprentices, students, and engineers. Price 2s. 6d.; post free 2s. 8d.—PERCIVAL MARSHALL & CO.

Mechanics.

"Elementary Heat and Heat Engines." By F. G. R. Wilkins, A.R.C.Sc., B.Sc. (Eng.), A.M.I.Mech.E., Demonstrator in Mechanics, Royal College of Science. Crown 8vo. Cloth, 7s. 6d. net.—OXFORD UNIVERSITY PRESS.

Gear Wheels Simply Explained. By Alfred W. Marshall, M.I.Mech.E. Clearly explains the first Principles, Proportions and Form of Teeth, Lantern or Pin Wheels and Racks, Bevel Gears, Worm Gears, Helical Gears, and many Special Forms of Gear Wheels. 63 pages, 60 illustrations. Price 9d. net.; 10d. post free.—PERCIVAL MARSHALL & Co.

Microscopy.

"The Microscope." A practical handbook. By Lewis Wright. Entirely revised and partly re-written by Aubrey H. Drew, D.Sc., F.R.M.S. Profusely illustrated. Fully explaining the manipulation of the instrument, the preparation, mounting and selection of objects, and with accurate information as to instruments and accessories. Price 8s. 3d., post free.—RELIGIOUS TRACT SOCIETY.

"The Beginner's Guide to the Microscope." By Chas. E. Heath, F.R.M.S. A splendid guide to all taking up microscopical work. Price 1s. 6d.; post free 1s. 8d.—PERCIVAL MARSHALL & Co.

Miscellaneous.

"Practical Engraving on Metal." A well-illustrated book which also deals with saw-piercing, carving and inlaying. Price 1s. 6d.; post free 1s. 8d.—PERCIVAL MARSHALL & Co.

"Petrol Motors Simply Explained." By T. H. Hawley. (Revised by E. W. Walford.) Describes the principles on which petrol motors work, and the use to which they are applied; illustrated. Price 1s. 6d.; post free 1s. 8d.—PERCIVAL MARSHALL & Co.

"Practical Electro-plating." By George Gentry. Deals fully with the electro-deposition of metals; illustrated. Price 1s. 6d.; post free 1s. 8d.—PERCIVAL MARSHALL & Co.

"The French Polishers' Handbook." Tells how to polish from the white, how to renovate furniture, gild and re-gild, how to polish inlaid, marqueterie, fretwork and poker-work, with many recipes for stains and polishes. Price 2s.; post free 2s. 2d.—PERCIVAL MARSHALL & Co.

Model Making.

"Model Sailing Yachts: How to Build, Rig and Sail Them." A practical handbook for model yachtsmen; illustrated. Price 1s. 6d.; post free 1s. 8d.—PERCIVAL MARSHALL & Co.

Motoring.

"The New Ford Car." By E. T. Brown. Cloth, fully illustrated, 2s. 6d. net.—OXFORD UNIVERSITY PRESS.

Motor Cyclist's Library.—B.S.A., Raleigh, Douglas, Triumph, Royal Enfield, Rodge, A.J.S., P. & M., Ariel. Nine books. Each 2s. net.—SIR ISAAC PITMAN & SONS, LTD.

Physics.

"Experimental Science for Junior Technical Students." By J. W. Bispham, Principal, Borough Polytechnic Institute. Limp cloth. 2s. net.—OXFORD UNIVERSITY PRESS.

Railways.

"British Railways, 1825—1925." A general outline of the railway systems of Great Britain. Profusely illustrated. 3s. 6d.—THE LOCOMOTIVE PUBLISHING CO., LTD.

"The Locomotive of To-day." Revised and Enlarged Edition. A most useful work of reference for those in need of practical information on modern locomotive construction. Fully illustrated, with drawings of details. Contents.—Section I: The Boiler, Firebox, etc. Section II: The Engine. Section III: The Framing, Wheels, etc. Section IV: The Tender, Brakes, etc. Section V: Articulated Locomotives. 5s. net.—LOCOMOTIVE PUBLISHING CO., LTD.

Reference Books.

"Practical Engineer Electrical Pocket Book and Diary." Edited by C. Arnold, A.M.I.E.E. With Buyers' Guide and Technical Dictionaries in French-English, Spanish-English, and Russian-English. Leather cloth, 3s.; Cloth, 2s. 6d. net.—OXFORD UNIVERSITY PRESS.

"Practical Engineer Mechanical Pocket Book and Diary." Edited by Ernest G. Beck, Wh. Ex., Assoc.M.Inst.C.E. With Buyers' Guide and Technical Dictionaries in French-English, Spanish-English, and Russian-English. Leather Cloth, 3s.; Cloth, 2s. 6d. net.—OXFORD UNIVERSITY PRESS.

"Useful Engineer's Constants for the Slide Rule." By J. A. Burns. All who have to make rapid calculations will find this a most helpful book. Many worked examples are given and methods of calculation. Price 2s.; post free 2s. 2d.—PERCIVAL MARSHALL & Co.

Television.

"Television." By Alfred Dinsdale, A.M.I.R.E. (Editor of the "Television Magazine"), with a Foreword by Dr. J. A. Fleming, F.R.S., the greatest living inventor. The only book on television which deals with the subject in an authentic and comprehensive manner. Written in language which you can understand. Post free 5s. 6d.—TELEVISION PRESS, LTD.

Wireless.

"The Elements of Radio Communication." By O. F. Brown, M.A., B.Sc. (Oxon.), B.Sc. (Lond.), late Scholar and Research Student Brasenose College, Oxford. With introduction by Admiral Sir Henry B. Jackson, G.C.B., K.C.V.O., F.R.S., etc. 10s. 6d. net.—OXFORD UNIVERSITY PRESS.

"Loud-Speakers: Their Construction, Performance and Maintenance." By C. M. R. Balbi, A.M.I.E.E., A.C.G.I. Cloth gilt, 110 pp., 3s. 6d. net.—SIR ISAAC PITMAN & SONS, LTD.

"Wireless Apparatus Making." By A. V. Ballhatchet. Dealing with the general principles governing the design, making and operation of all kinds of wireless apparatus (Receiving outfits only). 187 pages; 138 illustrations. Price 3s. 6d.; post free 3s. 9d.—PERCIVAL MARSHALL & Co.

"Wireless Facts and Figures." By A. V. Ballhatchet. A most useful book for those engaged in experimental work. Fundamental formulae and tables are given, which save much time and trouble. Price 6d.; post free 7d.—PERCIVAL MARSHALL & Co.

"Wireless Working Hints for Beginners." By Archibald Williams. A most useful book to all who install a wireless set. Well illustrated; 93 pages. Price 1s. 6d.; post free 1s. 8d.—PERCIVAL MARSHALL & Co.

Workshop.

"Machine Shop Companion." Splendid pocket book, cloth bound, 80 illustrations, includes "Screw-cutting." Post free 1s. 9d. (abroad 2s.).—BENTLEY'S PUBLISHING CO. (Dept. M.E.), Halifax, Yorks.

Practical Lessons in Metal Turning. By Percival Marshall, C.I.Mech.E. The best instruction book on the lathe for young engineers and amateur mechanics; with 220 original illustrations; 210 pages. Price 3s.; post free 3s. 3d.—PERCIVAL MARSHALL & Co.

"Marking Out for Machinists." By Capt. Richard Twelvetees. A workshop handbook for apprentices, improvers and engineering fitters. 69 pages; 34 illustrations. Price 9d.; post free 10d.—PERCIVAL MARSHALL & Co.

"Practical Hand Forging." By Capt. Richard Twelvetees. Outlining the principal operations connected with forging, welding and the use of appliances for dealing with anvil work. 64 pages; 40 illustrations. Price 9d.; post free 10d.—PERCIVAL MARSHALL & Co.

"Fitting and Adjusting Bearings." By Capt. Richard Twelvetees. Deals with use of tools, scraping bearings, machine processes, and how to avoid common errors. 60 pages; 29 illustrations. Price 9d.; post free 10d.—PERCIVAL MARSHALL & Co.

The next "Modern Technical Books" Guide will appear in our issue dated March 7th.

All letters relating to
Advertisements or Deposits
should be addressed to
The Advertisement Manager.

These Bound Volumes

will be highly appreciated by

Young Engineers.

"JUNIOR MECHANICS."

Vols. 5 to 8. Price 6/6 per vol.
post free.

Vols. 9 to 12, } Price 7/- per vol.
and 14. } post free.

"THE MECHANICAL BOY."

Vol. 1 (26 issues). Price 9/3
1924-5: post free.

"THE MECHANICAL AGE."

Vol. 2 (12 issues). Price 6/3
1925-6. post free.

"MODEL RAILWAY NEWS."

Vols. 2, 3, and 4. Price 9/3 each,
(12 issues each). post free.

Send your remittance to the Publishers:

PERCIVAL MARSHALL & CO.,
66, Farringdon St., LONDON, E.C.4.

YOU NEED HELP

It is very difficult to prosper in life without a little help.



LET ME BE YOUR FATHER

I have acted as father and adviser to thousands of others. I give advice free and when I do so I feel the responsibility of a father, either in advising a career or in guiding our students to success. Having been the self-constituted father and adviser to thousands of others, it is possible I may be able to help you and guide your footsteps so that you may make a success of your life.

THE MOST SUCCESSFUL AND MOST PROGRESSIVE CORRESPONDENCE COLLEGE IN THE WORLD.

IT IS
QUITE TRUE

and I state most emphatically that there are thousands of men earning less than half of what they could earn simply because they do not know where the demand exceeds the supply. Thousands of people think they are in a rut simply because they cannot see the way to progress. This applies particularly to Clerks, Book-keepers, Engineers, Electricians, Builders, Joiners, etc. They do not realise that in these particular departments the demand for the well-trained exceeds the supply. In technical trades and in the professions employers are frequently asking us if we can put them in touch with well-trained men. Of course, we never act as an employment agency, but it shows us where the shortage is. In nearly every trade or profession there is some qualifying examination, some hall-mark of efficiency. If you have any desire to make progress, to make a success of your career, my advice is free: simply tell me your age, your employment and what you are interested in, and I will advise you free of charge. If you do not wish to take that advice you are under no obligation whatever. We teach all the professions and trades by post in all parts of the World, and specialise in preparation for the examinations. Our fees are payable monthly. Write to me privately at this address, The Bennett College, Dept. 17, Sheffield.

COMMERCIAL

Accountancy
Advert. Writing
Salesmanship
Army Certif. Course
Auctioneering and Estate Agency
Auditing
Banking
Book-keeping
Civil Service
College of Preceptors
Commercial Arithmetic
Commercial Law
Company Law
Costing
Economics
English and French
Executive Law
Foreign Exchange
General Education
Modern Business Methods
Police Entrance and
Promotion Courses

COMMERCIAL—Con.

Secretaryship
Workshop Organisation

INSURANCE

Exams. for Agents and Officials,
F.C.I.I.
Motor, Fire, Life, Marine
Employers' Liability
Auctioneers, F.A.L.P.A.

TECHNICAL

Teacher of Handicrafts
Applied Mechanics
Architectural Drawing
Building Construction
Clerk of Works' Duties
Boiler Engineering
Boiler Making
Chemistry
Civil Engineering
Concrete and Steel
Draughtsmanship

TECHNICAL—Con.

Electrical Engineering
Practical Mechanical Engineering
Engineering Costing, Quantities
and Specifications
Foundry Work
Heat Engines
Heating, Ventilating and Lighting
Internal Combustion Engines
Marine Engineering, B.O.T.
Mathematics
Matriculation
Metallurgy
Motor Engineering
Naval Architecture
Pattern Making
Post Office Examinations
Road Making and Maintenance
Sanitation

TECHNICAL—Con.

Builders' Quantities, Costing and
Estimating
Shipbuilding
Structural Engineering
Surveying and Levelling
Surveyor of Works, R.E.
Telegraphy and Telephony
Town Planning
Transport, A.M.Inst.T.
Wireless Telegraphy
Works Managers' Course

MINING

Fireman's Exam.
2nd Class Mine Manager
1st Class Mine Manager
H.M. Inspector
Mining Elec. Engineer
A.M.E.E.
Mining Mech. Engineer
Mine Surveyor

Note Address:

THE BENNETT COLLEGE,
Dept. 17, SHEFFIELD.



The MODEL ENGINEER

Edited by
PERCIVAL MARSHALL C.Mech.E.

Assist. Editor: WALTER RUNCIMAN
Business Dept.: ALFRED DAWSON
Tech. Research and Workshop Dept.:
ALFRED W. MARSHALL, M.I. Mech.E.
A.M.I.E.E.

Editorial and Publishing Offices:
66 FARRINGTON STREET LONDON
E.C.4

Single copies, 4d., post free 5d.
Annual Subscription, 21s. 8d., post free.

VOL. 60. No. 1448

FEBRUARY 7, 1929.

PUBLISHED
EVERY THURSDAY, 4d.

SMOKE RINGS



THE real engineering enthusiast finds a delight not only in historical models but in old engineering books. Many of the old books on mechanics and engineering are very elaborate productions, particularly in the way of illustrations, and I never cease to admire the beautiful line engravings of engines and machines which are to be found in some of the classic works. Modern process engraving has done much to cheapen the cost of production of engineering drawings, but in quality of line and perfection of detail many of the old-time plates are superior to anything which is being published to-day. I have been looking through a catalogue of rare engineering and scientific books recently sent to me by the well-known antiquarian booksellers Messrs. Henry Sotheran & Co., of 140, Strand, London. The catalogue itself is fascinating reading, for it reveals that technical books were a prominent feature of publishing activities in the seventeenth, eighteenth, and early nineteenth centuries. The list covers scientific and industrial books of all kinds, in various languages, and I have noted several entries which I know would attract many of my readers. For example, there is a book by a French author, Gallon, giving a record of all the more important French machines invented between 1666 and 1754, including scientific instruments, telescopes and microscopes, clocks and watches, and firearms. To illustrate this book there are nearly 500 folding copper-plate engravings. There is a book in Italian by Jacques Besson, dated 1582, supposed to be the first independent work on machinery to be published; Bergeron's "Manuel du Tourneur," and Plumier's "L'Art de Tourneur," both well known eighteenth century standard books on lathe work, are also in the list. A particularly interesting volume is that by the famous Marquis of Worcester, who

was so prominently associated with the early development of the steam engine. One hundred inventions claimed by the author are detailed in this book. The marquis thus quaintly describes his work, "A century of the names and scantlings of such inventions as at present I can call to mind to have tried and perfected which (my former notes being lost) I have, at the instance of a powerful friend, endeavoured now in the year 1655 to set these down in such a way as may sufficiently instruct me to put any of them in practice." Several editions and reprints of this book are available at prices ranging from 10s. 6d. to £25. Still another interesting item is a first edition of the first printed work of Hero of Alexandria, "containing descriptions of about one hundred small machines and mechanical toys, many of which are very ingenious, including an account of a small stationary steam engine which is of the form now known as Avery's patent." From these brief references to some of the entries in this list, it will be seen that Messrs. Sotheran hold a stock of very fascinating historical engineering and scientific literature; the list itself is numbered 813, and it covers no less than eighty-six pages. Those of my readers who are interested in the writing of the pioneers of engineering, or who are in search of data and drawings for the construction of historical models, will find the service of this firm very helpful.

* * *

North-country readers should note that the Seventh Exhibition of the Huddersfield Society of Model Engineers will be held at the Technical College on March 22nd and 23rd. In addition to the competition events for members only, there will be several open classes of engineering models, wireless apparatus, and model sailing yachts, and gold, silver and bronze medals are offered as well as other prizes. All entries must be made by March 8; forms and full particulars

may be obtained from Mr. F. Bates, 18, Whitly Avenue, Fartown, Huddersfield.

* * *

A novel way of earning a living with the aid of a model railway is described in *The New Yorker*. It appears that in a commodious basement on Riverside Drive in New York, Mr. Newson has installed a very complete model electric railway. He invites boys from private schools in the neighbourhood to come and enjoy the fun of running a model railway, and, incidentally, to learn something about engines, electricity, and railroad operating. The boys are formed into classes, and each class pays twenty-five dollars for a two-hour session. Several classes are attending this novel course of instruction, and the boys in each class are formed into an operating staff and graded according to their intelligence and ability. The brightest boy becomes chief signalman; the grading is done by giving or deducting marks for good or faulty operation. Once a year the various classes have what is called a "grand

tourney," and the boy who shows up best in his model railway knowledge is elected President of the road. I do not know how such a scheme would succeed in this country. In any case, it would have to be located in a moneyed district with plenty of enthusiastic boys available. But I think it is an idea which might be developed in other ways. A museum of working models might possibly be made a paying venture, especially if the educational side of it is turned to good account. The happy boys of London can feast their eyes on the wonderful models in the Science Museum for nothing, but in other sufficiently populous districts a small museum, with good instructive talks on engines and railways, might provide an alternative to the cinema which many parents would approve and willingly pay for.

Percival Marshall

FITTING AND OPERATING MICHELL BEARINGS.

A paper on this subject, given by J. F. Petree, A.M.I.Mech.E., A.M.I.N.A., before the Junior Institution of Engineers on January 18, drew attention to the fact that the original British patent was granted to Mr. A. G. M. Michell for his bearing nearly twenty-five years ago and that it now found application in machines of diverse types, in some of which the special needs essential to the satisfactory working of the bearings were not understood; some of these being in thrust assemblies without proper provision for oil circulation, and with insufficient oil capacity; it was pointed out that the oil in a Michell bearing had to do duty as a coolant as well as a lubricant. It was important that as thin an oil as possible should be used in order to reduce the losses that must occur if a thick oil was thinned down by heat generated in the bearing itself.

The positioning of the pivotal point or line on the backs of the pads was referred to, and the effect of its position behind, before or on the centre line of pressure on the pad explained, the last position being usually used in situations involving a change in the direction of rotation without alterations in the direction of the thrust, i.e., in the adjusting blocks of reversible turbines.

The advantages of a line pivoted pad compared with a point pivot was its ability to stand up to pressures which would crush a point pivot and further as the working face of the pad was parallel to both its back surfaces (the "line" being a definite step between the latter two planes), an accurate measurement of the pad thickness could at any time be made. Pads being machined in sets, if renewal is necessary they should be replaced in sets.

Pads were made either of cast iron, cast steel, gunmetal or phosphor bronze, the choice depending mainly on load and cost, resistance to bending being the first consideration. It was found in practice to be advisable to coat the front of the pad with whitmetal, at all events for loads up to several thousand pounds per square inch, and it was essential if the bearing was to start under load; as although the oil film is struck at a rubbing speed of less than ten feet per minute, a bearing which has been standing under load for some time and is then required to start under load may suffer damage in the short interval before the film is struck. The whitmetal absorbs sufficient oil to provide a greasy film for starting even after long periods of inaction. In remetalling, a mixture of copper 5.5, tin 86.0, antimony 8.5 per cent. will be found a safe selection. The whitmetal should be held by dovetailing into the pad.

In contrast with the ball bearing, the load-carrying capacity of the Michell bearing increases with the revolutions.

It was stated that probably more than 90 per cent. of such troubles as were met with in the running of Michell bearings could be attributed to an insufficiency of oil or dirty oil. Lubricants could be applied in three ways: (1) plain bath lubrication, where the oil level is at the under-side of the shaft; (2) flooded lubrication, where the whole housing is filled with oil and involving the use of shaft glands which should not compress the packing hard on the shaft; and (3) force feeds, usually found in geared turbine installations.

A MODEL "PLANET" TYPE LOCOMOTIVE.

An Old-timer: Some Notes on How to Build her.

By Geo. Gentry.

General Note.

The photograph (Fig. 1), which is that of an old model recently purchased in a second-hand shop in the London district for a few shillings, should serve as an instance of old-time practice, both as a prototype and as a model. Leaving out of consideration the motion work of the engine as on the model, the type of locomotive represented is that which is generally called the "Planet" type. A generic name adopted by the Stephensons for a series of locomotives of the four-wheel type, the first of which was called the "Planet," of date 1830.

The "Planet" Type Loco.

The type as a whole was the start off of the method of placing the motion under the boiler, and with the cylinders under the smokebox.

Previously, when all those curious kinds of loco, having beam engines, vertical engines, bell-crank engines, and what not, had been discarded, Stephenson evolved a four-wheel type called the "Rocket" type, which were based fairly closely on that locomotive, and had outside diagonal or sloping cylinders. Some of these will be remembered as "Meteor," "Comet," "Dart," "Arrow," "Phoenix," "North Star," and "Northumbrian," not forgetting the "Invicta," which had diagonal cylinders forward. Of all these, "Northumbrian" appears to be the first and, with a few exceptions, the only one to have a modern form of firebox. These locos differed a good deal, and it was not till the coming of the "Planet," fitted with a similar boiler to "Northumbrian," that the first note

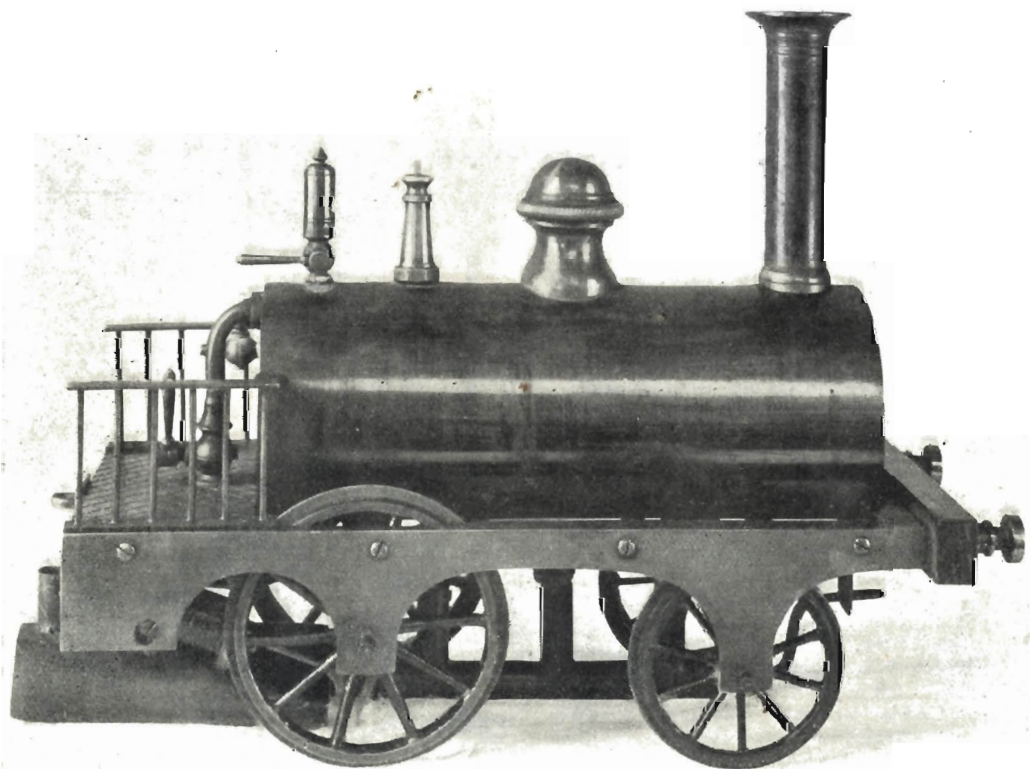


Fig. 1. Old Model "Planet" Type Steam Locomotive.

was struck to standardise a type in which cylinders were placed forward, and low down, and driving wheels were placed behind some form of leading wheel, thus setting a type which is as they are to-day. The general arrangement of the first "Planets" were 2-2, driving on the rear wheels. These were augmented by the production of the 0-4 coupled type, for "goods" traffic. In 1832 a loco was designed, just as the last-mentioned, with the addition of a pair of trailing wheels of arrangement 0-4-2, which was really the first six-wheeled engine put into regular use, although others had been produced. The greatest development, which was really a departure from the "Planet," was the production of the "Patentee," in 1833, of arrangement 2-2-2. All were tender engines and had outside frames. The "Planets" therefore include, in general chassis construction, the four-wheeled "Bury" locos, and date from 1830 to beyond 1840, while the six-wheeled engines date from 1833 onward. The latter, of the 2-2-2 type, include the "Harvey Combe" (1835), a contractor's locomotive, and it was in 1837 that this type

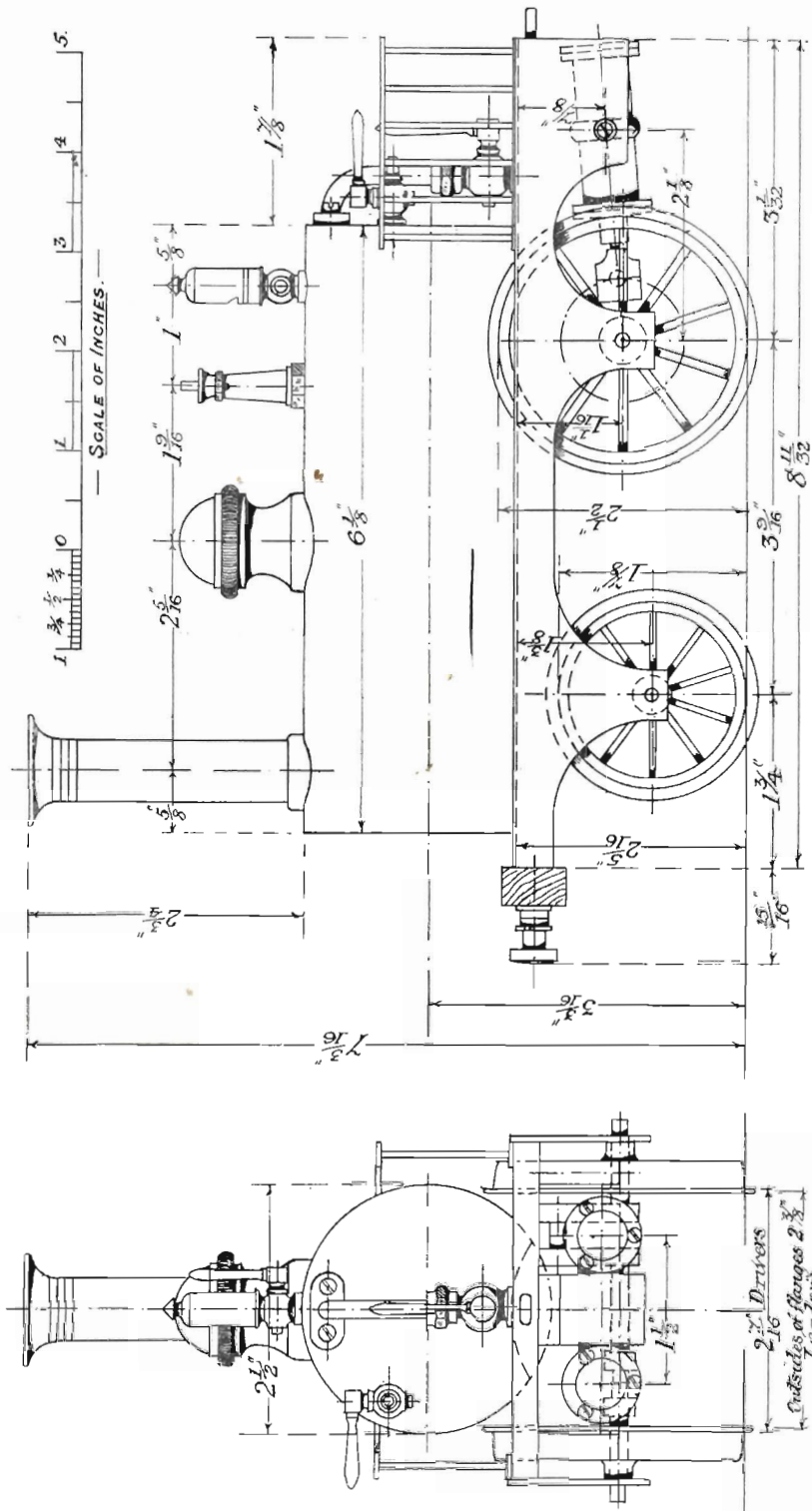
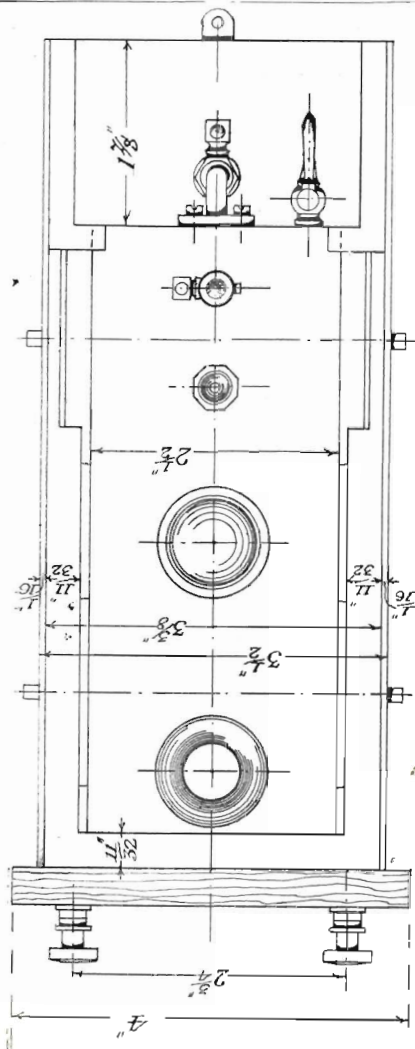
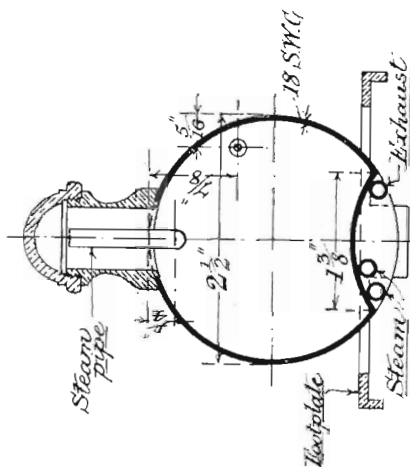


Fig. 3.—Scale General Arrangements of a Simple Model Steam Loco, Back End View and Side Elevation. (Amended to run on a $\frac{3}{4}$ -in. gauge track.)



FIGS. 4 and 5.—Respectively, a Plan View of Simple Model and Cross Section of Boiler through the Dome. (Both to same scale as Fig. 3.)



became standardised. The "Planet" locos, therefore, were the first passenger engines of the type we use to-day, and, as such, they are not too well represented in the model locomotive world.

Some "Planet" Models.

It is difficult to locate any real "Planet" models that are old. An example occurs in the "Colossus," a 2—2 double-frame "Planet" with semi-outside cylinders (*i.e.*, cylinders between frames but driving on outside cranks). It is a beautiful 1 1/2-in. scale model of a one-time Dublin and Kingstown Railway loco, of date about 1834, and constructed for that line by G. Forrester, of Liverpool, who made similar engines for the Liverpool and Manchester, and London and Greenwich. This model is illustrated and described on pages 558-9 of Vol. X of this journal (June 16, 1904 issue), and is now in possession of Messrs. Thos. Parsons & Sons, of 315, Oxford Street, London, W.1, in whose permanent exhibition at this address this model can be seen in motion running on a coin-in-slot gear. Yet another has been illustrated in THE MODEL ENGINEER, on page 23 of Vol. XXXIII. In this case it is a "Planet" four-coupled, coupling rods omitted. Of modern models of the type Mr. H. G. M. Conybeare's "Planet" deserves mention, and Mr. Greenly illustrated one of an L. & M. Railway loco (made, the writer believes, for Mr. Ernest D. Löwy) in his "The Model Locomotive" (London: Percival Marshall & Co., now out of print). This note may serve to bring to light perhaps others, both ancient and modern, but there are not many. In view of this, it is interesting to note that the earliest types of commercial model locomotive were of the "Planet" design, made, for simplicity, like Fig. 1, to act with oscillating cylinders; the better qualities of which had, again as our illustration, double-action cylinders, as seen in Fig. 2. An underside view.

Some Historical Commercial Model Notes.

One has to go back to the history of the Stevens Model Dockyard, of Aldgate, to get at the originals of the trade in working models, as a business by itself. It appears that some time previous to 1866, when that business was moved to Aldgate from Tower Hill, that the then Mr. Stevens employed a model engine builder. But it appears that his work had more to do with model engines for boats, and it would be interesting to know definitely if model locos were produced for sale at this date and by that firm. It seems clear, however, that even previously model locos were made for the philosophical instrument trade, and sold by such firms as Dolland, Doublet, Newton, Stewart, Elliott, and others. We know such kinds of shop business to-day as an opticians, but in those days this kind of business dealt, not only in optical instruments, spectacles, and the like, but also in all kinds of scientific, electrical and physical

apparatus, and included a few kinds of working model steam engines, generally with oscillating cylinders. It is thought that this model before us, with its missing tender, is one of these, and that it cost completed about £5, which at its date (perhaps sometime in the 'fifties) was equivalent to over double of to-day's money value.

A Suggestion to Model Loco Beginners.

It is thought that many readers who want to produce a working model loco entirely on their own account will find the carrying out of the present design a helpful stepping-stone to the achievement of building, say, some of the more complex 4-6-'s. It will involve some careful silver-soldering and a few careful machine jobs, e.g., the making of the cylinders and crank-shaft. Beyond this it is plain sailing, and as a whole will, we hope, appeal to the many

posed that intending makers construct all except the whistle, steam-cock with union, and gauge cock, which can be purchased from regular stock. The safety valve is special, and will have to be made. As seen in Fig. 2, the boiler is made fluted on underside, to house in the spirit flame top, the funnel being carried down to this fluting through the water space. Steam is taken from up in the dome, and in our amended design is delivered first through a looped superheater pipe running along the flute, as seen to the left in Fig. 5. This is not on the model as seen in Fig. 2. The exhaust pipe, however, running along the other side of flute is to be seen in that picture. It delivers to the funnel, consequently the whole system includes from dome to steam block, via the cock, from thence to superheater, trunnion block, cylinders, exhaust pipe

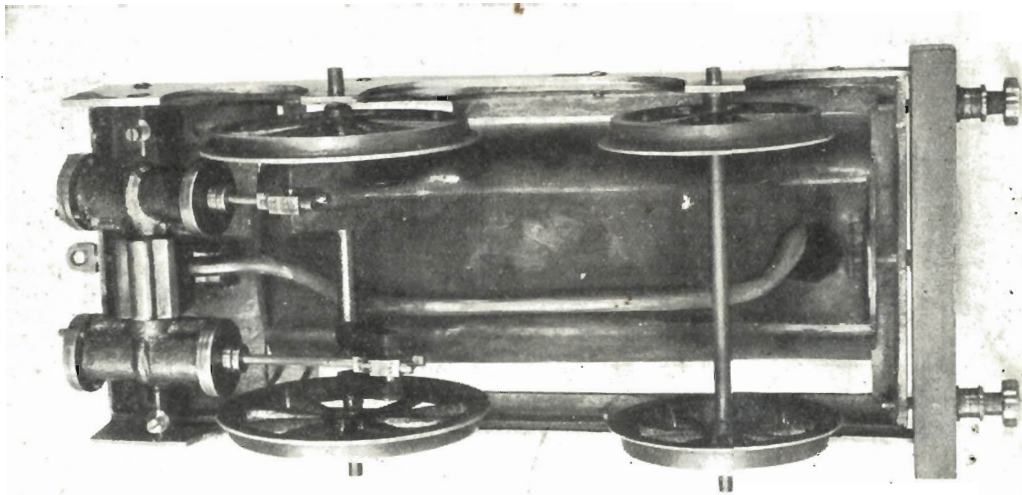


Fig. 2.—Underside View of Old Model showing the D.A. Oscillating Cylinders and Fluted Bottom of Boiler.

budding enthusiasts who nowadays cannot give overmuch time to very elaborate work and yet like to build something that runs under its own steam. With this in view a first batch of scale general arrangement drawings have been produced.

The Drawings.

Fig. 3 shows a side and back-end elevation, giving all the main dimensions. The actual model is for 2½-in. gauge, with ¾-in. full bore cylinders, by 1½-in. stroke, 1½ ins. long over flanges. This has been modified to 2½-in. gauge with cylinders ¾ in. exactly, by 1½-in. stroke, but 1½ ins. long over flanges, to give a thicker piston. Fig. 4 is a plan view, with Fig. 5 a cross-section of boiler at mid line of dome. The whole model is made in brass, with steel crank, and fore axle. The only other steel parts are some of the screws and piston-rod. It is pro-

posed that intending makers construct all except the whistle, steam-cock with union, and gauge cock, which can be purchased from regular stock. The safety valve is special, and will have to be made. As seen in Fig. 2, the boiler is made fluted on underside, to house in the spirit flame top, the funnel being carried down to this fluting through the water space. Steam is taken from up in the dome, and in our amended design is delivered first through a looped superheater pipe running along the flute, as seen to the left in Fig. 5. This is not on the model as seen in Fig. 2. The exhaust pipe, however, running along the other side of flute is to be seen in that picture. It delivers to the funnel, consequently the whole system includes from dome to steam block, via the cock, from thence to superheater, trunnion block, cylinders, exhaust pipe

and funnel. But in the photo the superheater is omitted. So far as design and dimensions are concerned, the drawings are self-explanatory, and it only needs now to point to the fact that the leading wheels are set a little closer to each other than the drivers for clearance.

A continuation of this article will give separate detail drawings with instructions how to build, reference being made back to these drawings for the main arrangement.

As a whole the model should be built-up excepting the wheels, detail drawings of which will be given later on, together with the other details. This will enable builders to purchase the nearest castings or finished wheels from stock, and alter them by turning down if necessary. The principal parts which may conveniently be castings are the footplate and cylinders. Instructions will be given how to make the patterns for these if desired.

SHOPS SHED & ROAD

A Column of "Live Steam."

By "L.B.S.C."

Correspondents Want to Know.

Before proceeding with "the doings," I had better clear up a few points which have arisen about "Fayette." Many correspondents have written to ask if a full set of blue prints will be available, and Mr. Eaton, of Hamleys, says he has been absolutely snowed under with requests for them. Well, the trouble is of course that I designed and built the engine, as usual, without a solitary pencilled line. The sketches which are accompanying these notes are taken partly from the actual machine herself and partly from a replica which is shortly leaving for South Africa. Anyone following the "words and music" should be able to put up the engine without any further aid; but as the call for prints has been made, the matter is being investigated, and if they can be supplied, it shall be done; so watch the advertisement pages. Many brothers want the engine in larger sizes, $3\frac{1}{2}$ -in. and $4\frac{1}{2}$ -in. gauge. Their wants can easily be supplied, as given dimensions need only be enlarged to suit. Briefly, in a $3\frac{1}{2}$ -in. gauge engine the main frames are half as large again, cut from $\frac{1}{2}$ -in. steel plate and spaced $2\frac{11}{16}$ ins. apart. Wheels are $\frac{3}{4}$ in. in thickness; drivers 5 ins. diameter on $9/16$ -in. axles, with axleboxes and springs same type as in the smaller size. Use either three cylinders $1\frac{1}{2}$ ins. by $1\frac{1}{2}$ ins., or four cylinders $\frac{3}{4}$ in. by $1\frac{1}{2}$ ins. Valve gear for the former may be either three separate sets, or the inside valve may be operated, by way of a change, by the American two-to-one levers actuated by the tail rods of the outside valve spindles. Will give a sketch of these for the smaller engine when we get that far. Four cylinders with opposed cranks as on the Great Western engines need only two sets of gear, as the inside valves are actuated by rockers. This makes a beautifully balanced engine, and simple with it. However, if anybody wants to make a super-extra job of the engine, it wouldn't be a bad wheeze to set the cranks like "Lord Nelson" on the Southern, viz., 135° spacing, giving eight puffs per turn, and use the Caprotti (Ca-"potty" the engine-men call it) valve gear. The purchaser of "Fayette" wants me to build "Ursa Max," the 4-8-2, with four cylinders, "Nelson" cranks and Caprotti gear; some repeat order, that—looks as though he is pleased! The Caprotti, or, in fact, any poppet valve gear, would be an

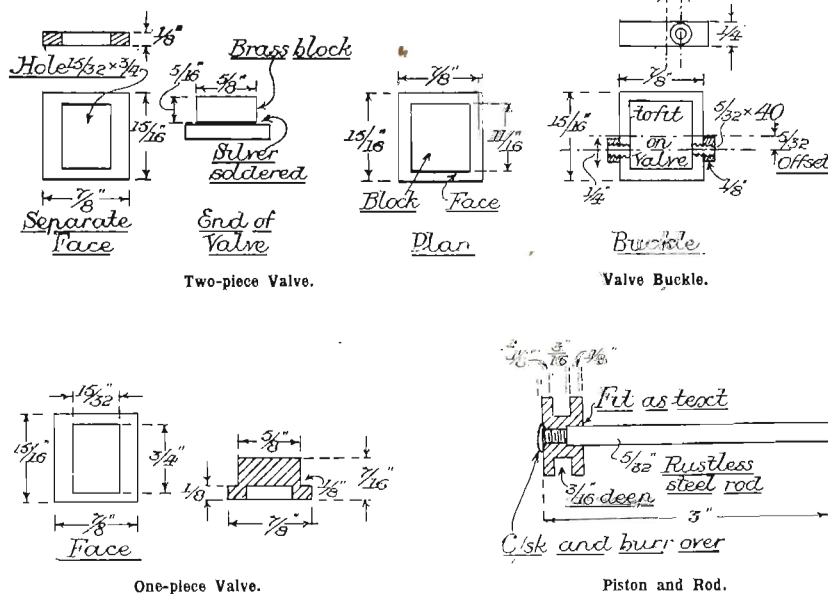
advantage in this case, because you only need one inlet and one exhaust camshaft with the single drive, no matter how many cylinders or how the cranks are set; whereas all the "Nelson" class are obliged to have four sets of ordinary gear, which entails extra expense both in construction and maintenance. By the way, Signor Caprotti himself has seen and examined "Fayette," and if I build the Caprotti-fitted "Ursa Max," shall try and get him to set out the gear for me. Nothing like going to the fountain-head, is there?

The $4\frac{1}{2}$ -in. Gauge Size.

This would make a fine engine; and with three cylinders $1\frac{1}{2}$ -in. bore and $2\frac{3}{4}$ -in. stroke, or four cylinders $1\frac{1}{4}$ -in. bore and $2\frac{1}{2}$ -in. stroke with $6\frac{1}{2}$ -in. driving wheels, it would put even "Helen Long" in the shade, and shift a far greater load than the usual so-called " $1\frac{1}{2}$ -in. scale" engine half as large again, with very little steam consumption. I guess the notion of using cylinders of above dimensions would have horrified some of the departed generation of "one-inch-scale, one-inch-bore" locomotive builders, and a great cry of "impossible" would have floated Heavenwards; but even before some of us found by actual experiment that big cylinders are correct it always appeared to me a ridiculous idea to cut down cylinder capacity and then allow steam to continue to flow into the cylinder long after the piston had passed its point of maximum crank thrust. Surely it is logical to regulate your steam supply to the pistons by means of the valves? It needs a given volume of steam to shift a given load; good. Then arrange to get that volume into the cylinder as quickly as possible, and give it a big piston to push against so that it can operate to the utmost advantage. I know quite well that this is not a scientific way of putting it, but it is gospel truth as I have proved in my own engines times and times again. An engine with cylinders $\frac{1}{2}$ in. by 1 in. supplied with steam from a water-tube boiler fired by a poison-gas plant, dropped from 80 lbs. to 40 lbs. pressure with a given load in sixty feet run. Timing was as advocated by the "old school," with valves almost lapless and steam admitted all but full stroke. I bored out the cylinders to $11/16$ in.; put in new valves, cut ports $3/32$ -in. steam, $3/16$ -in. exhaust, all $\frac{3}{4}$ in. long, and fitted new motion arranged to

cut off at 70 per cent. in full gear. With the same boiler and the same lamp unaltered in any way, steam would now rise from 60 to 80 lbs. in one double trip with the same load as before. If that isn't proof, I don't know what is. Reverting to the big engine, the main frames can be made from $\frac{5}{32}$ -in. plate, with buffer beams of $1\frac{1}{2}$ -in. by $\frac{1}{2}$ -in. flat bar well bolted and angled up. Mr. Kennion has a lot of castings both of "Helen Long" in $\frac{1}{4}$ -in. gauge size, and his North British Atlantic, which can be used in building "Fayette" to the big size. Double all the principal given dimensions, excepting, of course, the width between frames, which will need closing in to suit $\frac{1}{4}$ -in. rail gauge instead of 5 ins., where the engine is

usual type. As a matter of fact, I had the latter in mind to carry on after I had done with "Fayette," seeing that a lot of my overseas correspondents live where narrow-gauge lines are in vogue, especially South Africa and New Zealand. Incidentally, I have just happened across the photo of a 3-ft. 6-in. locomotive, here-with reproduced, which will be of use to those who want a tank engine for a narrow-gauge road, where the fuel is very poor. She would come out quite big on $2\frac{1}{2}$ -in. gauge, as big as the average $3\frac{1}{2}$ -in. gauge tank. Owing to the wheel arrangement, a very large firebox could be fitted, and fired through a chute as on Mr. Rodger's machines, while the boiler barrel could be enlarged to bring the type up to modern



required to run on a "standard inch-stroke" track already laid.

Miscellaneous Queries.

Somebody wants to know whether he should use Hamleys' or Kennion's castings, as the prices vary. Please yourself, it doesn't matter much. Hamleys' have a special metal which is very tough but works up fine; they also have some of my original patterns. Mr. Kennion made his own, but seeing that he holds the Championship Shield of the S.M.E.E., he is well able to do that little job, whilst the quality of his metal is very good. Now, turning to another subject, some brothers want to know when I am going to break away and give a description of a little edition of an uncommon engine, such as the Kisson-Still, or the Swiss Locomotive Co.'s three-cylinder geared tank engine, or a turbine gadget, or even a narrow-gauge pattern of the

practice. Anyway, one thing at a time; let's get on with "Fayette's" components.

The Gland and Tail Rod Bosses.

These are turned from $\frac{9}{16}$ -in. round stock, either brass or bronze. The sizes are given on last week's sketch and no detail description is needed as it is just a plain turning job. Open out the spindle holes with a pin-drill in case the $\frac{9}{32}$ -in. tapping drill does not truly follow the spindle-hole drill, which would cause the gland to bind on the valve spindle when tightened—a disease I found on every cylinder, without exception, made by the now defunct Sheffield firm of junk purveyors. The glands are bronze, of the usual pattern, and tight enough in the threads to prevent working loose when the engine is at work. Screw the bosses into the steam-chests while still in place on the cylinders, which will make certain that they don't get put

in the wrong road about, forming "a pair of odd ones." Grip the boss in the three-jaw, hold the steam-chest and cylinder-block in your hand, and go right ahead. A smear of red lead paste may be applied to the threads if desired, but if the threads are left tight, as they should be, this is not essential. The steam-chest covers are merely plain pieces of brass plate $\frac{1}{8}$ in. thick cut to overall dimensions of steam-chest top. Remove steam-chest from cylinders after marking which is which, and top and bottom; clamp each cover on its steam-chest with a toolmaker's clamp and use holes in steam-chest as jig to drill the cover, which should also be marked for ease of assembly. Next, valves, pistons and rods.

Pistons and Piston-rods.

Pistons must be of a different grade of metal to that used for cylinder blocks, otherwise the cylinder bores will probably groove or score. They can be turned from $\frac{3}{8}$ -in. drawn phosphor-bronze rod, or rustless steel. Chuck, face the end, rough-turn to $\frac{1}{64}$ th in. over finished size, groove out for packing, and then carefully centre and drill down No. 30 for $\frac{1}{2}$ in. depth. Open out about $\frac{3}{16}$ th in. deep with No. 23 drill and part off. Repeat; then re-chuck the piston blanks and run a $\frac{5}{32}$ nd-in. by 40 taper tap through, using plenty of lubricant and guiding the tap by the tailstock chuck. Cut two 3-in. lengths of $\frac{5}{32}$ nd-in. ground rustless steel rod. Chuck, and put about $\frac{1}{4}$ in. of thread on each, making certain it is true by using the tailstock die-holder described in back notes. Then grip a piston blank truly in the three-jaw, and hold the rod in the tailstock chuck; screw

home by pulling the belt with your hand. The part of piston-rod immediately below the thread will be drawn into the plain part of hole in piston head, and unless the rod gets bent, it will be true and remain so. Anybody who has a lathe fitted with collet chucks can hold the piston-rod in one and easily finish to size, with the certainty that piston and rod will be concentric; but if you only have an ordinary lathe, chuck a 1-in. length of $\frac{3}{4}$ -in. round brass, face, centre, drill through No. 22 and mark a point opposite No. 1 chuck jaw. Remove, and make a hacksaw cut from outside into bore, splitting the bush longways; replace in original position in the chuck jaws, insert the piston-rod in the bush and tighten up the chuck. The rod should now run true. Take a few very light skims off the piston flanges until it is a very tight fit in bore and can only just be entered. Then either set in the cross-slide half a division on the "mike" collar—if one is fitted—or else shift the handle just the tiniest bit and take another skim. This will get the "cold" clearance right; and when the piston is hot and oily, it should be steamtight without relying on the packing. Don't be tempted to ease pistons with a file or emery-cloth; they *must* either be turned or ground to size.

Valves, Rods and Buckles.

We haven't described making buckle-driven valves before, so the following will be of fresh interest. The dimensions of "Fayette's" valves are given in the sketch, and they may be either chopped out of the solid in one piece or made in two pieces and silver-soldered together. The one-piece valve can be a bronze or German silver

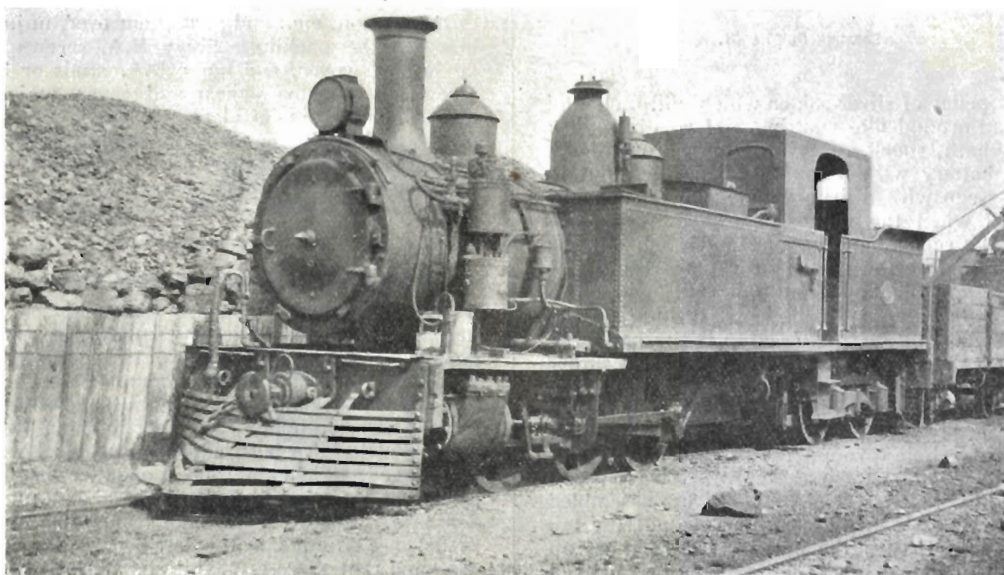
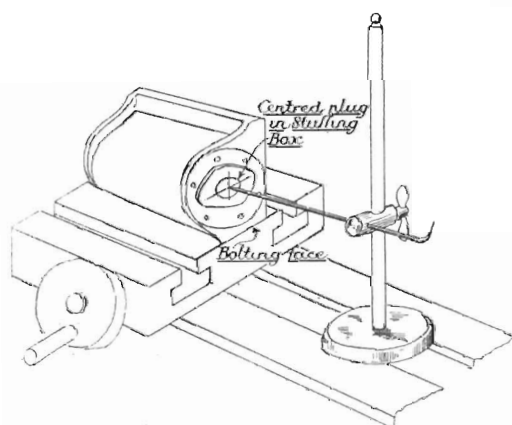


Photo by]

Narrow Gauge 0-6-4 Tank Engine.

[W. W. Stewart.

casting, or made from bar material, needing no special description as it is a plain filing or milling job. The built-up valve is as old as the hills and has many adherents, chiefly because you can file out the exhaust cavity and try it over the ports. In this case, it should just span the inner edges of the steam ports, showing a black line at either side with valve in mid-position, as a shade of inside clearance allows of closer notching up. The top part of the valve can be filed up as a solid block to fit the buckle without shake, and the two pieces wired together and secured with a tiny bit of silver-solder. There is no earthly reason for anybody to funk this simple silver-soldering job, as it can be done with even a mouth blowpipe. All you do is to anoint the joint with a smear of Boron compo paste (or ordinary borax and water will do at a pinch), blow on it till it gets bright red and then apply



Locating Guide Bars.

a tiny pellet of silver-solder which will melt and flow all around like winking. If you haven't a pickle bath, sneak a tiny drop of acid out of the radio battery with a fountain-pen filler, put in an egg-cup with a little water, and quench out in that when the redness has died away; but mind the splash, and be sure and wash out the egg-cup before the good lady catches you. The buckles are filed up from flat rod. Cut off a piece long enough to allow for turning up the bosses; parting off in the lathe is the best way to ensure square ends. Turn the bosses either between centres, or use the four-jaw chuck; I prefer the latter as they can be centred, drilled and tapped for valve rods at the one chucking. Drill a big hole through the centre of the blank and file it square to fit the valve. The rods are $5/32$ -in. rustless steel rod and are assembled with the buckle in the steam-chest—put the tail piece in first, then the buckle; couple those up and then the driving piece can be pushed through the gland and screwed home.

Alternative Valve Drive.

The "flat and slot" drive is not suitable for such a big valve, but the screwed spindle and nut method of actuating may be used if preferred; it is slightly less trouble than the buckle. Slot the back of each valve across and longitudinally; the former slot to take a piece of $1/4$ -in. by $1/4$ -in. flat rod without shake, and the latter to accommodate the valve rod which is screwed $5/32$ -in. by 40 for $1 1/4$ ins. of its length. The $1/4$ -in. piece of flat rod is drilled and tapped to suit, dropped in the cross-slot and the valve rod screwed through it. This is a well-known wheeze and used commercially; but they usually give too much slop, and also unless the steam-chest has a removable cover, valves cannot be set by sight. The screwed part of the valve rod can run in the tail bush just as it is, air can escape around the threads; or it may have the threads turned off and a hole drilled in the tail bush an easy slide fit. File a flat on it if you adopt the latter plan.

Locating Guide Bar Holes.

Before assembling, mark out holes for guide bars as sketch. Make a plug with a centre pop, to fit in piston stuffing-boxes. Lay cylinder on the lathe saddle or anything flat, bolting face down; set scriber to level of centre pop and scratch across face of oval boss. With small dividers, step off two intersections $3/8$ in. from centre, at each point drill No. 40 and tap 5 B.A. To make certain holes are true and square, leave cover in position and either stand cylinder, cover up, on drill press table, or hold it against a drill pad in lathe tailstock, and operate with drill in lathe chuck. The cylinders can now be assembled. Don't bother to pack pistons or glands yet, otherwise you might get tight places in the motion, etc., and pass them over, unjustly blaming the packing. Six 7 B.A. screws will do in each cover, and ten 5 B.A. studs or long screws in the steam-chest and cover, which is merely a plain brass plate. A couple of holes may be drilled in the latter for doping purposes, and either plain hex. head screws or proper cups fitted—which you please.

Next, guide bars, yokes and crossheads.

Exhibition of Models in Oxford Street.

This exhibition, which has apparently become permanent, is for collecting money in aid of disabled soldiers and sailors. It is situated in the showrooms of Messrs. Thomas Parsons and Sons, varnish and enamel manufacturers, 315, Oxford Street, London, W., near to Bond Street. New Models have been added and the collection rearranged. The exhibition is open free between 9 a.m. and 7 p.m.; Saturdays 9 a.m. to 8.30 p.m. Visitors should note that some of the models are situated on the first floor up the staircase and that there are paintings and ornaments included in the exhibition.

WORKSHOP TOPICS

On Making of Milling Cutters.

By B. G.

That milling cutters are useful, no one will deny. That they are indispensable, no one who has to manage without will admit. In the following article I propose to show that the making of these is really a simple matter to anyone possessing a lathe, a vertical slide, and a milling attachment, which latter he can make for himself very cheaply. Possibly there are many like myself who have feasted their eyes on the catalogues illustrating these tools, and whose ardour has been damped by considerations of price, not that I wish to suggest that they are not value for money in most cases, but the pockets of the great majority of model-makers

are not deep enough to enable them to equip their lathes with a really comprehensive selection of these very useful tools.

I have vivid recollections of the work involved in digging out the cavities of the crossheads for a pair of cylinders I made some years ago. These were formed by means of drills, hammer and chisel, and, finally, files to finish. This job took some of the enthusiasm out of me, so I experimented with a piece of silver steel filed to square section and tempered. This, when revolved in the chuck, certainly removed the metal in a fraction of the time expended on the old method, but when I picked up the catalogue

Fig. 4.—The Arbor.

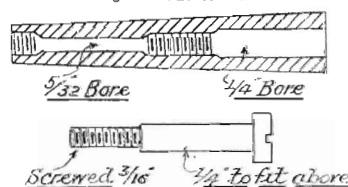


Fig. 4a.

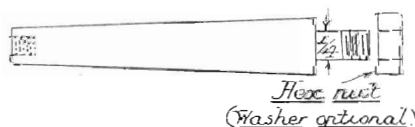


Fig. 5.

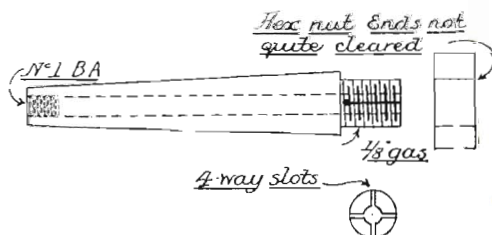


Fig. 3.—Taper Chuck.

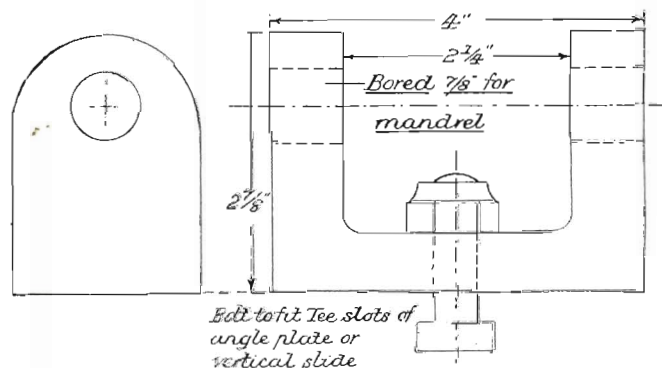


Fig. 1.—The Dividing Head.

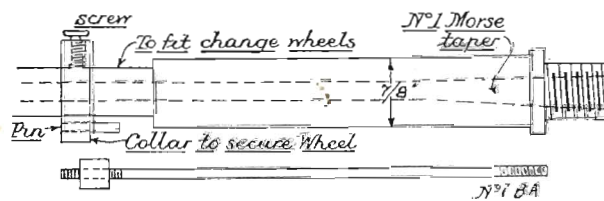
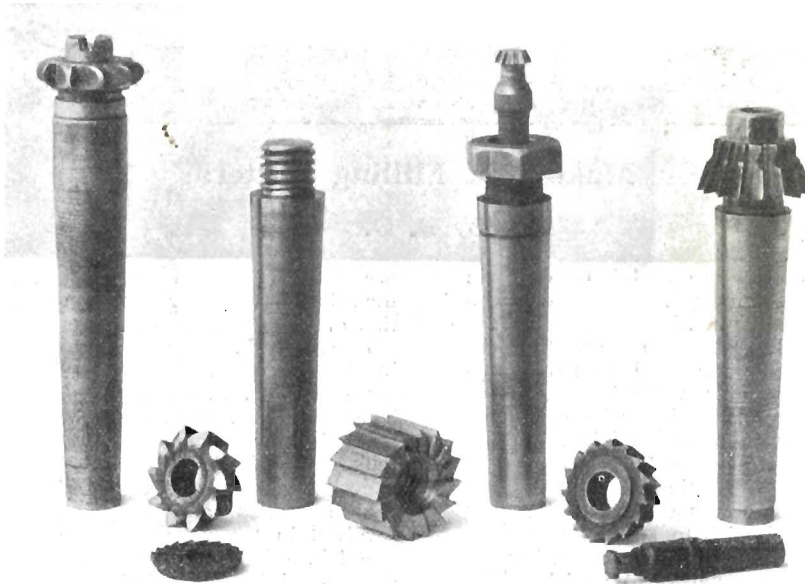


Fig. 2.—The Dividing Head Mandrel.



A Group of Chucks, Arbors, and Milling Cutters. The hand-cut one is seen standing between two arbors on the left.

and saw the stereo of the real thing with its perfectly-divided flutes and sharp teeth, my own attempt looked, by comparison, like a very poor relation, and I made a solemn resolution then and there to make one exactly like it or never look my lathe in the face again.

Maybe, you who read this, have a 4-in. Drummond; at least, I hope so, as it was with this tool that I made the milling cutters this article refers to. I have had for a long time some ordinary slotting mills, and one day it occurred to me that the round hole in the tool-post might be made use of, so I turned a bar to fit this, drilled a 3/16th-in. hole centrally at one end, and left the other end so that the changewheels should fit tightly. I then turned a piece of cast steel to fit the 3/16th-in. hole and secured it by a set-screw. This bar was then put in place in the tool-post, which might now be regarded as a dividing-head. The angleplate supplied with the lathe was bolted to the cross-slide and the tool-post mounted on this with a 30-tooth change-wheel on the end of the mandrel, every fifth tooth of which was marked. One of these was then brought opposite another mark on the post and the whole secured by the two screws. The "dividing head," after being adjusted to the correct height, was clamped and the first flute formed by one of the slot mills, then another division was brought round to the mark and treated in the same manner, and so on until all six flutes had been cut. The success of the result proved to me the possibilities of the system, and Messrs. Drummond, Ltd., holding a competition about this time, I photo-

graphed the setting-up of the device, and was fortunate enough to win second prize for the idea.

I then made a pattern for a proper dividing-head (Fig. 1), and got a firm to cast it and face the under side. When this was received I drilled a hole through the centre of the base and fitted a sturdy clamping bolt for holding it down. I decided on a single bolt to enable the attachment to swivel in any direction as this is essential when machining angular cutters. The casting, which was of iron, was bored about 7/8 in. with a bar running between centres, which bore is just far enough from the securing nut to enable the lathe spanner to be got over this when the mandrel is in, which, in addition to turning some of the hexagon off the nut, makes it possible to turn this when it is in any position.

In a previous article I described the making of a new mandrel for the lathe headstock from a Ford axle. I did this for the reason that I prefer a nose bigger than 1/4 in. When it was complete I bored right through it and enlarged the nose bore to No. 1 Morse taper, which I accomplished partly by the method of setting the cross-slide and finishing with a home-made reamer. This was simply a length of cast steel turned to the same taper, filed down to just below half its diameter and tempered. A rough tool, perhaps, but it effectually cleaned the bore up to size, and the resulting mandrel has been in use (and pretty hard use, too) for over four years. The discarded one came in admirably for use on the dividing-head, and when it was required for this

purpose it was replaced and bored right through like the new one, but before removing from the lathe, a hollow centre was put in and the countersunk part skimmed up till it ran dead true, the mandrel was then reversed in the headstock and the back centre trued. Mr. Ford was then reinstated and operations commenced on Mr. Drummond, who was placed between centres and reduced to a nice fit in the bore of the dividing-head. A shoulder was left for thrust at the nose end and the whole thing shortened to the new requirements (Fig. 2). As I considered that the changewheels would take a lot of beating for dividing purposes on account of the large number of variations they allow, I arranged the other end for these as before, but in order to make a real job of it, a collar was fitted containing a pin and set-screw, to lock the wheel on, in imitation of the method used on the lathe itself. A brass thumb-screw locks the mandrel at its stopping place. Why brass? Well, brass is not likely to bruise it. No doubt a ratchet lock is considered the proper thing, but where dividing wheels of widely varying diameters may be required, it would be of little use. Next, we require some precision chucks and arbors to hold the cutters. Don't be frightened, they are quite easy to make, as they consist merely of shanks turned taper to fit the bores of either mandrel. The small ends are bored and tapped for drawing in, and, in the case of the chucks, the big-ends are reduced for threading $\frac{1}{2}$ -in. gas, bored to the sizes required, and split four ways (i.e., two cuts) for a distance of $\frac{1}{2}$ in. (Fig. 3). To this is fitted a hex. nut, tapped, but not quite cleared at one end, which, when screwed up, effects a real grip, and the result is a chuck of fixed precision qualities, which well repays the time spent on it. The arbors (Figs. 4 and 4A) are rather different, but the method of producing them is quite simple. They are first drilled right through $\frac{5}{32}$ in., then a $\frac{1}{4}$ -in. drill is put through for about $\frac{1}{2}$ in., after which a $\frac{3}{16}$ -in. Whit. tap is introduced for about $\frac{1}{2}$ in. of what is left of the first bore. This is rather a delicate operation, and must be carried out with care if you wish to save your tap. So much for this part.

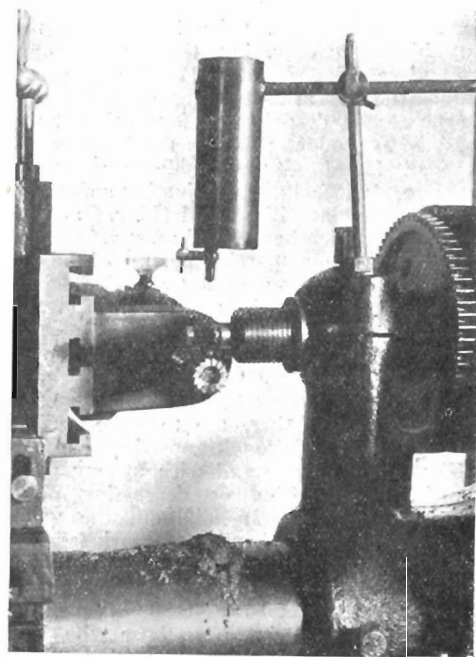
The arbor proper is made from a length of $\frac{1}{2}$ -in. silver steel turned down for the first $\frac{1}{2}$ in. of its length to $\frac{3}{16}$ in., then another $\frac{1}{2}$ in. or just over is reduced and finished to fit without shake into the $\frac{1}{4}$ -in. bore just described, and the small portion tapped $\frac{3}{16}$ -in. Whit. It is then parted off to leave a head of about $\frac{1}{2}$ in. in which a slot is cut or milled, and it is ready for use. Don't bother about keys or keyways; just screw the head up tightly with a large driver, and you will find that the milling action only tends to tighten the grip of the screw head. I haven't been troubled with slipping, anyhow.

Provided that your drills start true, and are correctly ground, your chuck bores will run dead

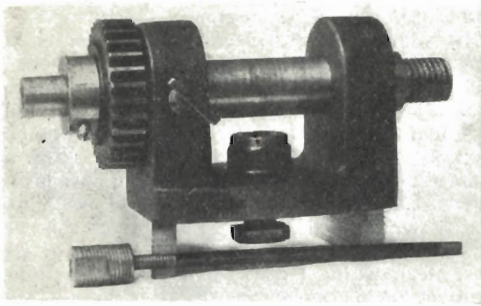
accurate, and, of course, the importance of this latter condition is understood.

In addition to the above, I made one or two arbors of different types. One of these is intended for the milling cutter to screw on and was tapped $\frac{1}{2}$ -in. Whit. Another, which is solid, is smooth for $\frac{3}{16}$ -in. from its shoulder, and the remainder tapped for a securing nut (Fig. 5). All the types have been used, and all have proved successful. A rod for each mandrel with nuts for drawing in the chucks completes this part of the work. I then obtained a length of $\frac{1}{2}$ -in. cast steel, which I centred at both ends; and a number of pieces of varying thicknesses were parted off with a little tool described some years ago in THE MODEL ENGINEER by Mr. Heath. This was a device for holding pieces of hacksaw blades, by two short lengths of $\frac{1}{2}$ -in. by $\frac{1}{2}$ -in. mild steel. I made this tool from Mr. Heath's instructions, and have been grateful to that gentleman ever since, and I really think our worthy chief might do worse than reprint this for the benefit of new readers.

One of these pieces is chucked, bored to fit on the arbor and faced at the same setting. The other side must be faced dead true with the bore, as correct running will depend upon this face being gripped evenly by the arbor head. In the case of a facing cutter, it will be necessary to recess this side in order that the arbor head may be well below the teeth. It is then mounted, and its diameter machined to size, and, as the first cutter you will require will be angular, it should



Making Milling Cutters: View from the Back.

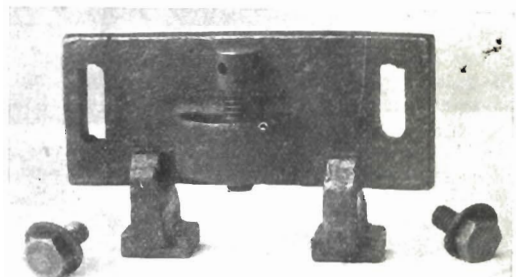
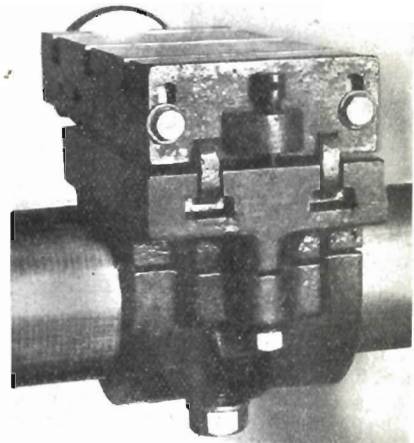


The Completed Dividing Head.

have its circumference machined to about 60° . The teeth of my first angular cutter were formed by hand. It was mounted on its arbor with its widest diameter facing the slide-rest, a circle scribed with a pointed tool about $3/16$ th in. from the edge, and the teeth marked off, dividing them with a changewheel. The blank was then removed, gripped in the vice, and the teeth carefully cut up to the circle, the finishing being done with a file, with which I also fashioned what I tried to believe were side teeth. When hardened and tempered, it was quite a presentable, and, what is better still, effective little tool. This, I proudly look upon as my MASTER CUTTER (with capital letters, please, Mr. Printer), as my first three mills were machined with it. It was shown round the family circle and evoked much admiration, especially from myself, who wasted much valuable time in this respect. At this stage, I fondly imagined that my troubles were over, but there were many snags and sawyers, as Mrs. Hominy says, and my first attempts at machining milling cutters made me almost despair and fancy that it was impossible to produce them on the lathe at all. I eventually found that the trouble was overhang of the slide, slackness of the adjusting strips, and the saddle. Herein is illustrated (Figs. 6 and 6A) a little device which has proved most valuable as a support for the overhanging portion of the top-slide. It is cast iron and two $3/4$ -in. screws in $3/4$ -in. slots secure it to the end of the cross-slide, and the feet engage in the T-slots of the saddle, while a tight fitting screw further improves this by bringing the feet to bear in an upward direction against the tees. By means of this, and careful fitting, the top-slide can be made to move to and fro with any degree of ease or stiffness you please, and without any possibility of the end lifting or depressing under machining stresses. In addition, the whole thing can be clamped when boring work fastened to the table, thus eliminating all vibration which might otherwise be caused by the overhang of this particular type of boring-table. These tips will be readily appreciated by those who have been up against troubles of this kind. The elevating sturt of the 4 -in. Drummond, I con-

sider an objectionable feature, viewed in the light of boring operations, though for tool setting, its value is inestimable.

My first success was a $1/4$ -in. slot mill with rather coarse teeth; next, I made another of the same type as the hand-cut one. Then my head began to swell, and nothing short of a slab cutter with facing teeth would satisfy me. This, before machining, was tapped $3/8$ -in. Whit. and screwed very tightly on an arbor. I decided to cut fifteen teeth on it and therefore used every second tooth in a thirty wheel. When all was ready, I took care to see that the slide was working without shake, that the arbors were drawn in firmly, and the cut started slightly over the centre of the blank to ensure that the effect of cutting should be to tighten, rather than unscrew it. The saddle was firmly clamped to the bed so that nothing should move it, and a light cut was taken. The wheel was then turned to the next division and another cut taken to mark the place for the second tooth. This was done to enable me to judge the depth of cut necessary to finish the teeth. The first cut was then returned to, and, having gradually elevated the vertical slide and machined the clearance until its shallow end all but reached the second cut,



Figs. 6 and 6A.—Showing Support for Overhang of Cross-slide.

I tightened up the adjusting strips that there might be no possibility of the vibration converting it into a "self-acting feed," after which no further attention was necessary, and the fifteen teeth were formed without mishap, using paraffin and turps as a lubricant. The feed, it should be understood, must be against the direction in which the cutter is revolving, unless you wish to be unpleasantly reminded of the disadvantages of backlash (see "Milling on Small Lathes.") The feed of the vertical slide was now released and the face teeth cut with the same setting by means of this, adjusting the depth of cut in the same manner as before, and taking care to clamp the slide not in use. When these were finished, the new mill was removed from its arbor with a pair of pincers; applied at the base of the teeth which were brought up to concert pitch with a fine file. It was finally hardened and tempered, and you may be sure that I was all impatience to see what my home-made milling cutter would do. For a test, I set up a loco cylinder casting on an angleplate, mounting the latter on the vertical slide, and machined the valve face. Then the faces of the fixing flanges and the rectangular sides of the valve face were machined at one operation. Later, a pair of hinged coupling rods were shaped from the plain

flat steel and the round ends milled by swivelling the rod about a pivot fixed vertically through its bearing. On another occasion four eccentric straps were placed together in the machine-vice and their edges and angles machined with two settings. The edges of this tool have been renewed once with a triangular carborundum stick, which, though it is probably not so good for the purpose as a grinding attachment, answers very well.

I have made besides, a number of mills of different types and sizes, including some very tiny slotting, angle, and end-mills, which are held in the Morse chucks, and therefore revolve and cut with perfect accuracy. The forming of the side teeth on angular mills, is not such an easy matter, as these work usually at the rear instead of the face, and unless you have a left-hand cutter, it involves the reversing of the dividing head and working backwards. In any case, two settings of the work are necessary, but it only means a little extra care and patience to accomplish it, in fact, the possibilities with this little attachment appear to be endless, and I can assure you that the sight of my little set, which can trace their descent back to one comparatively disreputable ancestor, affords me a good deal of pleasure.

CUTTING A RACK FOR THE LATHE BY HAND.

By H. V. Nunn.

Recently, the writer wanted to improve his lathe by fixing to the bed a rack and to the saddle a bracket carrying a spindle with a handle at one end and a pinion gearing with the rack at the other end, the object being to relieve the guide screw of much of the work of traversing the saddle, and so prevent the screw from becoming unduly worn. The position of the guide screw and the arrangement of the bracket carrying its split nut, would not allow of the rack being made more than $\frac{3}{8}$ in. wide. It was therefore decided to make the rack out of 1-in. by $\frac{3}{8}$ -in. wrought iron or mild steel bar, and to cut the teeth, twelve diametrical pitch, by hand. A fairly straight piece of 1-in. by $\frac{3}{8}$ -in. wrought iron black bar of the length required, 2 ft., was obtained, and the mill scale cleaned fairly well off the sides. The edges were then filed up approximately straight and parallel and square with the sides. For this purpose the top of the lathe bed was used as a surface-plate. Whilst trueing up the edges of the bar, the writer got a surprise, and the experience will perhaps be a useful hint to others. It was found that, although the colouring matter smeared on the lathe bed showed nearly continuously along one

edge of the bar, looking for "daylight" distinctly showed this edge to be slightly concave. Originally, this edge had been very much more concave and in rubbing, as the concavity was reduced, considerable pressure had been applied. Experiment and calculation agreed in showing that a few pounds pressure, which can comfortably be applied at the centre of the bar with the fingers of one hand, is sufficient to bend the bar to the extent of about two thousandths of an inch. After finding the above facts, care was taken not to apply any pressure other than that of the weight of the bar itself.

The teeth were cut by means of an ordinary hand hacksaw and frame. Adopting teeth of $14\frac{1}{2}^\circ$ obliquity, a sawing guide (A Fig. 1A), $\frac{1}{4}$ in. thick, was first made, as follows: The saw measured .025 in. on the blade and .040 in. over the teeth. Then, since twelve d.p. = .2618 in. circular pitch, the distance between the parallel sides of two consecutive teeth requires to be $.2618 \text{ in.} \times \cos 14\frac{1}{2}^\circ = .2535 \text{ in.}$, which enables the dimension x to be calculated and made exactly right by means of a micrometer. Thus $x = .2535 \text{ in.} + \frac{1}{2} \times .040 \text{ in.} - \frac{1}{2} \times .025 \text{ in.} = .261 \text{ in.}$ To make the saw cut for the tongue B,

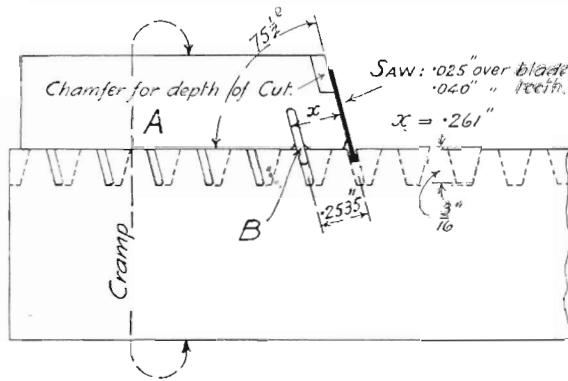


Fig. 1a.

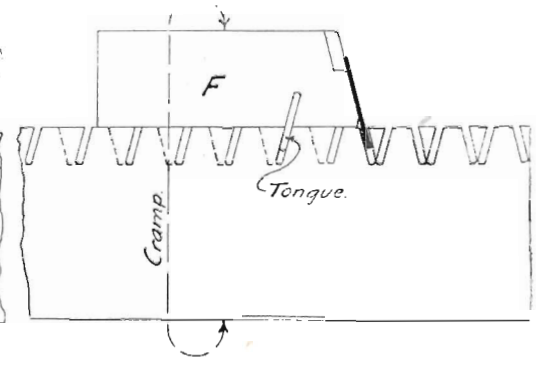


Fig. 2.

a piece of $\frac{1}{4}$ in. thick metal, C Fig. 1b, was filed to the correct angle, the point taken off to clear the saw teeth, cramped to A, and the saw blade guided by keeping it pressed against the sloping end D. In this, and in all subsequent sawing, the parts were gripped in the vice so that the

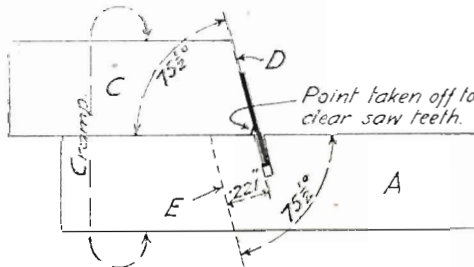


Fig. 1b.

sawing was done vertically. The corners at the entrance to the saw cut were then filed off and an iron tongue made to fit it tightly. The projecting part of the tongue was filed lightly and evenly until it fitted easily, but without perceptible shake, into a saw cut of the proper depth, i.e., $\frac{3}{16}$ in. from the edge, made

similarly in and near to the left hand end of the bar which was to become the rack. The line E was marked on A, and making a suitable allowance for filing up, the unrequired part was sawn off. The sloping end of A was then filed up, keeping it at the correct angle with the edge and square with the sides, until the micrometer gave the reading arrived at above. The working depth of the teeth being $\frac{1}{48}$ in., $\frac{1}{48}$ th in. was allowed for clearance, making the total depth $\frac{3}{16}$ in. A was now set on the rack bar with its tongue in the cut already made, and a second cut made to the proper depth. While in this position, A was marked with a scribe so that the chamfer could be formed to indicate when each successive cut had been made to the proper depth. Before making further cuts, it was thought prudent to case-harden the guiding face. The first range of cuts along the edge of the bar was then completed, as a straightforward job, it being necessary, of course, to see that, at each setting, neither burrs nor cuttings interfered with the guide making proper contact with the edge of the bar.

To make the second range of cuts, a guiding piece F, as shown in Fig. 2, was made, the same procedure in making the saw cut for and

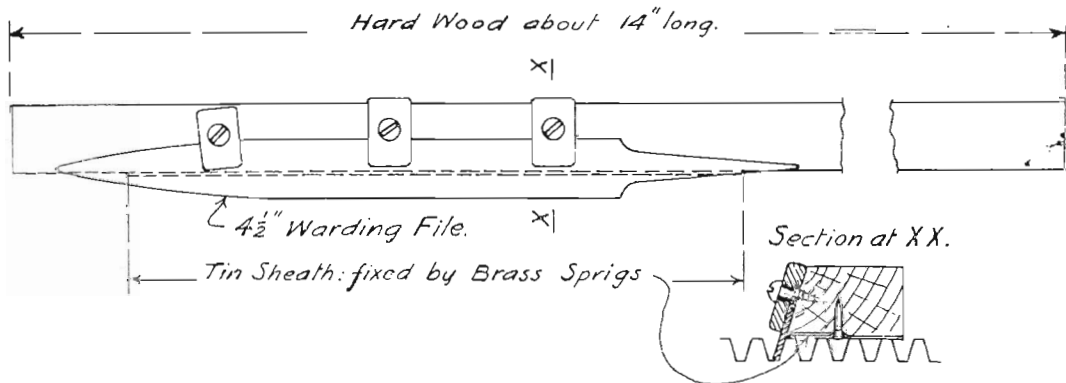


Fig. 3.

fitting the tongue being followed. In this case, one tooth and space had to be skipped, as the tongue would be too near the sloping end. Also, as there seemed to be no simple means of calculating and applying a direct micrometer measurement, the proper position for the sloping end was arrived at by trial and reduction until teeth of correct thickness were being cut. This was done on the rack bar itself and the too thick teeth afterwards reduced (on the proper side) by filing. The guide was then chamfered, case-hardened, and the second range of cuts completed, except the last one which, of course, had to be done separately. The vee-shaped pieces of metal in the teeth spaces were easily knocked out with a punch. To smooth the teeth faces, do any trimming that was found necessary, and

to take off the ridges at the bottoms of the spaces, the instrument shown in Fig. 3 was made and used. It is self-explanatory and proved to be well worth making. With it, it is easy to apply considerable pressure on the file, and, being long, facilitates keeping the file square with the rack.

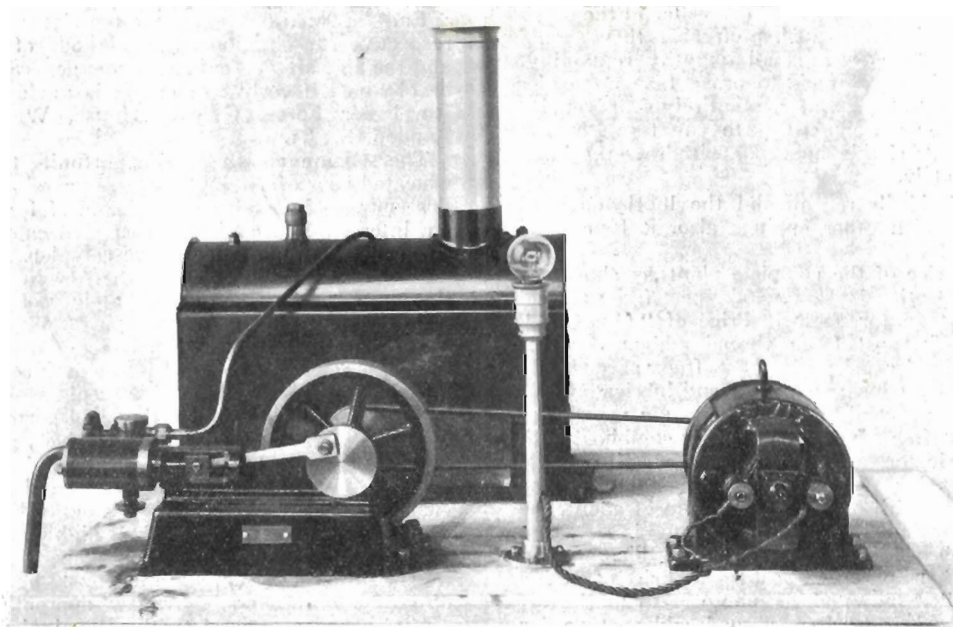
Finally, a piece of hard wood was faced up in the lathe, and while still on the faceplate a hole was bored in it for a peg the size of the pinion bore. A metal peg was fitted, and three pieces of hard wood were cramped on, so that the rack could slide between them and at the proper distance from the pinion. In this way, the meshing was checked and any tendency to jam removed from the rack by means of the file and holder depicted.

NEW TOOLS AND SUPPLIES.

Steam-driven Model Electric Lighting Plant.

Messrs. Stuart Turner, Ltd., Market Place, Henley-on-Thames, have submitted to us for inspection and trial a sample of their newly introduced model electric light plant. This is designated as the "One-One," a term which applies to the engine alone, the engine and boiler, or to the complete lighting outfit. Any of the items may be obtained separately, and each has the "Stuart Turner" characteristic of

thoroughness and reliability, judged by our examination and test. The boiler is the "Stuart" No. 499 "Babcock" type, with solid-drawn copper drum 2 ins. diameter by 6 ins. length, brazed throughout, and working with a steam pressure of 25 to 30 lbs. per sq. in.; firing is by methylated spirit. The engine is fitted with a rustless steel piston valve and connecting-rod; the cylinder is not a casting but is machined



The Stuart Turner Steam-driven Lighting Set.

from extruded metal. Dynamo is the "Stuart" miniature alternator, which has been regularly on the market during a considerable period. A special item is the No. 155 steam stop valve and lubricator combined. This may be obtained separately and may be omitted from the outfit if desired at a reduction in price. Drive is by means of a steel spring⁵ belt. The boiler is entirely enclosed by a pressed-steel case; the chimney is detachable, and the entire plant is mounted upon a fire-resisting base 14 ins. by 9 ins. dimensions. The electric lamp is supported on a nickel-plated brass column at a height of 5 ins., the column fits into a socket from which it can be easily removed.

We have made several trials with the sample plant, and found that a run of about twenty minutes duration is given with one filling of the boiler. Using hot water steam was raised in two and a half minutes from lighting the lamp; with lukewarm water in six minutes; and cold water eight and a half minutes. Tests were made with the engine running free at various speeds and driving the dynamo to light the lamp at various degrees of brilliancy. In some of the tests the water was intentionally evaporated away entirely so that the interior of the boiler was dry. This outfit is a miniature engineering job throughout, is of substantial construction, and bears a good resemblance to full-size plant. We confidently recommend it to the notice of our readers. The engine cylinder is 7/16th-in. bore by 3/4-in. stroke, a size quite capable of doing appreciable work in driving models or for any similar purpose. We do not advocate that users should continue runs until the water in the boiler has entirely evaporated, preferably they should be timed to leave a small quantity remaining. Our trials were made to prove that no explosion occurs if the water is entirely evaporated—the engine merely ceases to run through lack of steam. If this happens, withdraw the lamp immediately.

We decidedly recommend the lubricator, and for use with other engines also, it functioned admirably.

The price of the complete plant as shown in the illustration is £3 17s. 6d., post free; abroad add postage for 22 lbs. Price of "One-One" engine £1, post free; abroad add postage for 4 lbs.; boiler price £1, post free, abroad add postage for 5 lbs.; stop valve and lubricator, 5s., post free; special heavy oil for same 1s. 3d. per tin, post free. The stop valve is combined with the lubricator, and fitted with an ebonite handle wheel which remains cool; one filling of the lubricator with oil serves for a run of about one hour duration. Price of the dynamo is 21s., post free, abroad add postage for 3 lbs.; spring driving belt, price 1s., post free. Price of engine and boiler, mounted as photo with lubricator, £2 12s. 6d., post free, abroad add postage for 11 lbs. With sufficiently powerful drive, dynamo is rated to light four 4-volt miniature lamps.

The engine is *not* supplied as a set of parts or as rough castings.

An Ideal Soap for the Workshop.

The pumice soap manufactured by Messrs. F. C. Calvert & Co., of Manchester, is no doubt already known to many of our readers. Those who have not tried it, however, should. It is pleasant to use and is exceptionally effective. It will deal successfully with fingers that are suffering from the effects of the accidental application of soldering flux, and this, as every model engineer knows, is a difficult job to deal with. For removing grease, ink, and other stains it is, of course, equally effective, and, speaking from personal experience, we can say it does not roughen or dry the skin, and can therefore be used by people who, for any good reason, wish to keep their hands in condition. The soap can be had in 3d. tablets from any good chemist, grocer, or oilshop.

VACANCIES FOR AIRCRAFT APPRENTICES.

Six hundred aircraft apprentices, between the ages of 15 and 17, are required by the Royal Air Force for entry into the schools of technical training at Halton, Bucks, and at Cranwell, near Sleaford, Lincs. They will be enlisted as the result of an open competition and of a limited competition which will be held in the near future by the Civil Service Commissioners and the Air Ministry respectively.

Full information regarding the dates of the respective examinations, the methods of entry, and the aircraft apprentice scheme generally can be obtained if early application is made to the Royal Air Force, Gwydyr House, Whitehall, London, S.W.1.

The scheme offers a good opportunity to well-educated boys of obtaining a three years' apprentice course of a high standard and of following an interesting technical career. Already over 5,000 aircraft apprentices have completed training at the technical schools of the Air Force, and the annual output is approximately 1,000 fully-trained aircraftmen.

The principal trades open to boys are metal fitter, a new trade brought into existence by the introduction of the metal aeroplane, which involves training in both fitting and sheet-metal work, fitter (aero engine), fitter (driver, petrol), fitter (armourer), coppersmith and metal worker, wireless operator-mechanic and electrician. The apprentices are given a thorough training in their trade by highly-qualified technical instructors and their general education is also carried on simultaneously by a staff of graduate teachers. A few apprentices of special promise proceed to the Royal Air Force Cadet College for training with a view to becoming commissioned officers.

FOR THE BOOKSHELF.

"The Mechanical World" Pocket Book, 1929. Manchester: Emmott & Co., Ltd. Price 1s. 6d. net., postage 3d.

Now in its forty-second year, this practical pocket book is brought up to date by the usual revisions and additions. These deal with flywheel proportions, compressed air, mild-steel tubes, wire ropes for cranes, valve-rod ends, and belt conveyors. Some new useful tables have also been added. Altogether this book is excellent value for the mechanical engineer.

The All Europe "Three." London: Sir Isaac Pitman & Sons, Ltd. Price 6d., postage 1d.

Containing 24 pages, this booklet gives complete instructions for building a radio receiving set with a high frequency stage, a detector, and a low frequency power valve. It is designed to meet the requirements of the regional scheme, and will give good loud speaker reception from twenty to thirty stations. A large folding diagram of circuit is included.

Workshop Practice. Edited by E. A. Atkins, M.I.Mech.E. London: Sir Isaac Pitman and Sons, Ltd. Volumes I and II. Price 6s. each, postage 4d. each.

This work is being issued in a series of volumes, of which we have received the first two. Vol. I deals with what may be termed the fundamentals of workshop practice. These include the nature and use of hand tools and gauges, calculations and formulæ, drawing and sketching, and engineering metals. Vol. II is devoted entirely to pattern-making and iron and brass founding. Both volumes are well written and are exceptionally well illustrated with sketches, drawings, and photographs. The paper, printing, and binding are good, and this series, when complete, will make an admirable reference library for the apprentice and engineering student.

The "Trader" Handbook, Diary and Garage Reference Book, 1929. London: The Trader Publishing Co., Ltd. Price 10s. 6d., overseas 12s. 6d., post free.

To everyone who has any trading connection with motor vehicles, from the nimble 250 c.c. bike to the ponderous three-ton lorry, this 1929 Handbook and Diary will be continuously useful. It is quite an outsize in diaries, measuring 12 ins. by 8 ins., and containing over 370 pages. The diary proper is arranged to give four days to a page, thus leaving one space every two pages for memoranda. Each page is ruled for date and cash, and it is interleaved with blotting paper. The principal contents includes matter on the following subjects: trade associations and societies; encyclopædia of the

law; motor-car Acts and Regulations; technical data; colonial and foreign import duties; import and export statistics (motor and cycle); railway charges explained; accumulator charging prices; cycle repair prices; motor repair and service charges; tyre inflation pressure table; spare parts and service depôts; wiring diagrams; specifications of current model motor-cars, motor-cycles, commercial vehicles (petrol, steam and electric) and agricultural tractors; buyers' guide; alphabetical list of proprietary names; and an alphabetical list of trade addresses. These headings only broadly indicate the nature of the contents which in fact conveys very detailed and comprehensive information invaluable to motor traders and users of all descriptions.

Wireless The Modern Magic Carpet. By Ralph Stranger. London: Messrs. S. W. Partridge & Co. Price 3s. 6d., postage 2 d.

This volume, which runs to a little over 300 pages, is written with the intention of securing the attention of several distinct classes of reader, each interested in wireless from his individual point of view. The author addresses himself in turn to the unconverted, *i.e.*, the individual who has not yet either made or used a set; to the beginner who is still very ignorant of the rudiments of wireless; to the experimenter who is "experimenting" in the dark because his technical knowledge is not sound; and to the expert whose duties include the delivery of lectures from time to time.

The first five chapters constituting Part I are calculated to give the unconverted something to think about. The author describes broadly what an immense field of varied interests is open to the listener. In Part II there are seven chapters forming a simple introduction to the technical side of wireless; Part III contains twenty-seven chapters and explains, still in quite simple language, practically the whole of the elementary technical matters with which the practical wireless user must be conversant if he is either to enjoy himself and not become a nuisance to the community. In Part IV the seven chapters deal with the legal aspect of listening; protection of inventions; how to experiment in the right way; and radio engineering as a career. There is also a complete list of broadcasting stations throughout the world with their wavelengths; a list of short-wave stations, and some other items of useful information. The whole book is very readable and is illustrated with diagrams where necessary, and some half-tone pictures of apparatus and sets now on the market, an interior of the studio at Savoy Hill, and portraits of several notable men in the scientific and wireless world.

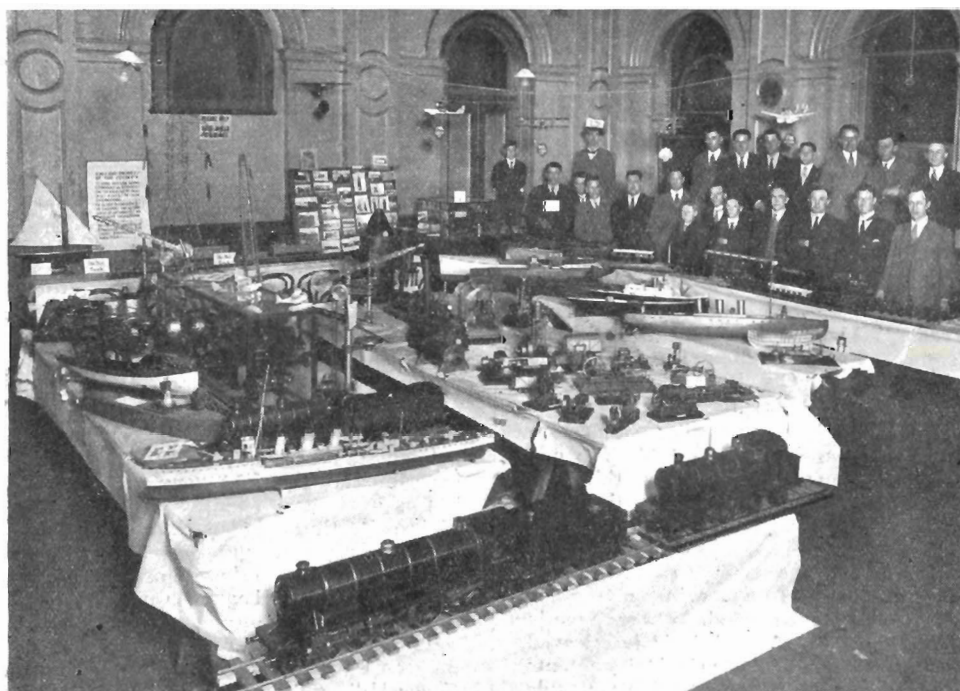
MODEL MAKING IN AUSTRALIA.

The First Public Exhibition by the Melbourne S.M. & E.E.

Our previous communication to THE MODEL ENGINEER was on occasion of the opening of the Beam wireless, in which was expressed greetings to yourselves and model-makers abroad. We now take the opportunity of reiterating those sentiments, this opportunity being the occasion of the first public exhibition held by the Melbourne Society of Model and Experimental Engineers. This was held in the Temperance Hall, Russell Street, Melbourne, on September 14 and 15. The show was an unqualified success. It was our first attempt, and solely a model exhibition; and our only advertising was a few announcements over the wireless and a few illustrations in the morning papers. We were a little dubious as to the result of a show of this character in Melbourne, but within half an hour of opening the door we were crowded out, and thence onwards approximately 250 persons an hour inspected the exhibits. As we were not conversant with the rules governing the raising of steam in public buildings, we relied upon compressed air for driving our stationary models. These consisted of a large number of various types of horizontal engines from $\frac{3}{4}$ -in. bore up to 2-in. bore. One notable exhibit was a

beautifully finished glass-case model of an entablature engine. A mill engine also shown, built by a boy of 13 years of age, was a creditable job. A horizontal engine, built by Mr. McCormack, from Stuart castings, embodied many improvements upon the standard. It was fitted with reversing gear, and the bolts used were smaller, nearer to scale, and greater in number than originally provided. A group of seven models from Mr. A. Grey included a twin-compound, a vertical engine and coupled dynamo and a gas engine. Mr. A. Davies showed a large vertical boiler; and our youngest member, Master Bert Langford, exhibited a horizontal mill engine $1\frac{1}{2}$ -in. bore by 2-in. stroke. This show of working models created a considerable amount of interest from members of both sexes, a large number of ladies visiting the exhibition.

In the railway sections there was an electrically-driven o-gauge model of a L.N.E.R. Pacific "Flying Scotsman," with the new corridor tender. This was operated by the builder, Mr. Wallace, who also operated a $\frac{3}{4}$ -in. scale "Precursor" tank loco on the Society's multi-gauge track. This track consists of o, 1, and $2\frac{1}{2}$ -in. gauge electric track. A large number of



At the First Public Exhibition held by the Melbourne Society of Model and Experimental Engineers, Melbourne, Australia.

steam locos were exhibited, too. An excellent glass-case model of a G.N.R. 1-in. scale single-driver and a Caledonian 4-4-0 by Mr. Robb; a Pacific 3-in. scale, built to 5-in. gauge, for passenger carrying, by Mr. Mahoney; a 4-4-2 tank "Mighty Atom," free-lance loco, 1-in. scale, by Mr. Ekman; a 3-in. scale model L.N.E.R. Pacific, solid-fuel loco, with Walschaerts valve gear, by Mr. Wakefield; and a 1 1/2-in. gauge solid-fuel loco, by Mr. A. Grey; and several others in various stages of completion, by Messrs. Teasdale, Coventry and Brown.

Amongst the large collection of rolling-stock was one worthy of mention, an o-gauge Pullman coach by Mr. Holland. This was of very neat workmanship, the inside fittings being most complete with tables, upholstered seats, lamp stands, flower bowls and carpets, etc. This was shown running behind Mr. Wallace's "Flying Scotsman," and, being electrically lit, was most realistic. Another, a 1 1/2-in. gauge electric motor coach shown on a section of rail with electric points and signal, by Mr. Senior. Other rolling-stock included wagons and trucks by Mr. Wallace.

In the dockyard section was a rather fine collection of vessels, one outstanding being a perfect model of a light cruiser (*Arethusa* class), electrically driven, built by Flying Officer Brown, late of the R.A.F. Others included a model of

the H.M.A.S. *Anzac* T.B.D., and a speed boat *Teaser*, by Mr. Ekman; sailing yacht by Mr. Fowler; model of a Commonwealth liner, designed for rough seas, by Mr. Hoyland; model of the *Santa Maria* by Mr. Nicol; an electric launch by Mr. Appleyard, and others partly completed.

Amongst the aeroplanes was a group of models of world-famous machines, and an excellently finished model of a seaplane, the Schneider Cup winner, by Mr. Bergersen. Two uncommon models were an ink grinding mill, loaned by Alexander Cowan & Son, printers' suppliers; and a 1,500-ft. water and oil boring machine, loaned by the Goldfields Diamond Drilling Co.

Trade exhibits were Drummond lathes from the Selsen Engineering Co., a case of Brown and Sharpe Tools by James Walker, hardware merchant; and the English model trade was represented by the Meadmore Engineering Co., who had a large and varied collection.

Our Society is about 40 strong. We find that the bulk of the work of organising an exhibition like this is left to a few enthusiastic members; however, we suppose this is the experience of other societies the world over.

Full information relating to this Society can be obtained from the Secretary, Mr. C. W. Senior, 57, Wilson Street, Brunswick, N.10, Victoria.

QUERIES and REPLIES

Querists must comply with the Conditions and Rules given with the Query Coupon in the Advertisement Page of each issue.

Selections from Queries recently replied to.

3104. Using an Automatic Cut-out on Higher Voltage.—H. R. (London, S.E.).

Q.—I have a 12-volt 21-ampere automatic cut-out taken from an aero-dynamo. I have been trying to make it work on 40 or 50 volts by altering the spring tension, but find it gets rather hot. Will this necessitate rewinding either of the coils, or will the high temperature not matter?

A.—If the cut-out has a double winding on the magnet, that is, a fine wire "voltage" coil and a coarse wire "current" coil, it will need partly rewinding before it can be made to operate direct on any considerable increase of voltage. The current coil need not, of course, be altered, so long as the current in amperes does not exceed the present rating particulars when working under the revised conditions. But if the voltage coil is now put on a 60-volt circuit instead of 12 volts for which it was originally designed, it will be taking five times the proper current. And since the heat developed in a wire is proportionate to the square of the current it carries, this five-fold increase will probably give a temperature rise twenty-five times as great as when working on 12 volts. Obviously, there is great risk of burning out the coil in such circumstances, and

two things can be done. The first is to rewind the voltage coil with a wire of one-fifth the sectional area of the original winding, and five times as many turns, which will result in the same total ampere-turns as originally and work with the same setting of the tension spring. The other alternative is to leave the windings as they are, but to put an extra resistance in series with the voltage coil so as to limit the current to the same value as when working on 12 volts. Not knowing what this current was, the required gauge and quantity of resistance cannot be stated; but if the resistance of the present voltage coil is known, it will be correct to make the series resistance four times this value, using Eureka wire about two gauges larger than the copper winding.

2945. Compressed Air for Running Steam Engine; Preserving Swan's Skin and Shark's Jaw.—T. F. C. (Boro' Green).

Q.—(1) I shall feel much obliged if you will give me information as to how I can drive a steam-type double-acting cylinder by compressed air. The size of the cylinder to be 2-in. bore by 2 1/2-in. stroke. The engine will be required to run at about 500 revolutions per minute. I should like the working pressure to be 100 lbs. per sq. in. I have a suitable

container for the air, 11 ins. diameter by 15 ins. high. (2) Can you also please state the best method of treating a shark's jaw? I purchased one while at Aden recently. It is a perfect specimen, i.e., all the teeth are O.K., but there is a little meat left on the jawbone. I believe the natives cut them away from the carcass rather roughly, and then bury them in sand. I do not seem to make much sense of it with a knife.

A.—There is an article dealing with theory of compressing air in *THE MODEL ENGINEER* of May 7, 1914. You will be able to work out the matter for yourself by the aid of the information given in this article; it includes a diagram giving the horse-power required to compress one cubic foot of free air per minute to pressures up to 100 lbs. per sq. in. The point of cut-off at which the engine slide-valve is set will affect the consumption of compressed air. The price of the issue mentioned is 6d., post free. The article is one of a series entitled "Notes on Model Air Compressors." (2) We have no information to recommend as to preserving the shark's jaw. Perhaps if you enquired of the Curator of the Natural History Museum, South Kensington, London, S.W., you could obtain some advice. The following is given in Spon's "Workshop Receipts," for preserving swan's skin: 6 ozs. arsenic, 3 ozs. corrosive sublimate, 2 ozs. yellow soap, 1 oz. of camphor, $\frac{1}{2}$ pint spirit of wine. Place in a saucepan over slow fire, stir briskly until all parts are dissolved into a homogeneous mass. The soap and the arsenic may be left out as they tend to make the skin greasy. Apply cold with a sponge fastened on the end of a stick. Should be marked *poison*.

3082. Direct Current Transformer.—L. T. H. (Teddington).

Q.—I want to obtain a supply of 12 volts 4 amperes from my house-lighting mains, which are 240 volts direct current, without going to the expense of a rotary transformer. Will you tell me whether the arrangement suggested by the enclosed sketch will function or suggest any other suitable method?

A.—The proposal sketched out by this correspondent is virtually a step-down transformer, the primary being supplied with interrupted direct current. The interrupter is a motor-driven mercury break working in an atmosphere of coal gas with a condenser across the break to absorb the spark. The interrupted direct current supply to the transformer will result in an irregular alternating current at the secondary of the transformer, the alternations being of small magnitude at "make" and very peaked at "break." A chemical rectifier of two cells working from a centre tapping on the transformer supplies current for the low voltage output. It strikes me at the first glance that, although such an arrangement will certainly function, the cost will be fully as great for the motor, interrupter, rectifier, and transformer, as it would be for a proper direct current to direct current rotary transformer to step down the voltage, if not actually greater. Added to this, there is the disadvantage with the querist's proposal that the wave form of the low voltage direct current so produced will be exceedingly irregular and so rapidly fluctuating in value that one could never be sure what the values actually were. There is also a large volt-drop through the cells of the chemical rectifier, and, all things taken into consideration, it is the writer's opinion that it would be far preferable to adhere to the more orthodox rotary transformer. The alternative is, of course, a series resistance, which would scarcely be economical in practice.

PRACTICAL LETTERS from OUR READERS

Beginning Practical Work. Simple Model-Making Tools.

DEAR SIR,—I fear Mr. Dillon suffers from excessive diffidence, like the lady surgeon in "Princess Ida," who flatly refused to "cut off real live legs and arms" except "in theory." Thirty years' reading of *THE MODEL ENGINEER* should be a very sound basis to begin a little practice on. But many of his remarks will meet general assent: the purchase of an expensive s.c. lathe will no more confer skill in turning than that of an assortment of files, chisels and scrapers will in fitting, while the cheaper lathes of very small size are hardly the tools most suitable for a beginner.

To my mind, far the best way to learn is to begin on a $4\frac{1}{2}$ -in. or 5-in. plain lathe, and learn the use of hand tools thoroughly, first on wood, then on brass. Such a lathe need not be expensive; my first one, as a boy, was purchased from a friendly old millwright (who had made it) for about fifty shillings. It had a wooden bed, wood pulleys, the heavy flywheel having a wooden ring with grooves attached by U-bolts to the spokes, and the simplest possible cone and point bearing mandrel. But it was comfortable to work at, as small lathes with low beds and skimpy flywheels are not, and I built more than one model engine on it that worked, though not exactly fitted to appear at the Horticultural Hall, while it was large enough— $4\frac{1}{2}$ ins.—for much useful woodwork. If someone would market a cheap set of lathe heads on these lines, the making-up of stand and bed would be within the capabilities of a moderate amateur carpenter; and I have known of a cheap, heavy flywheel made by its ingenious owner in reinforced concrete.

As to chucks, except for faceplates, prong, and driver, the economist must be content with boxwood or lignum vitae; a few blocks, bored and screwed for the mandrel nose, are all that are needed for doing light, accurate brasswork—such as for microscope or telescope—and much preferable to scroll chucks for such work. The important thing is *practice* with the gouge and chisel on wood, and with the graver on brass and steel. The use of the other types of tools for hardwood and brass will then present no difficulty. The watchmaker's method of using the graver should also be learnt—it is often useful for small work. Even when a slide-rest is available, much small work can be done more expeditiously by hand.

The idea of having special tools for individual jobs, such as boring cylinders, seems more appropriate to the professional than the amateur. The cost of several special tools would buy one universal tool, and the amateur will have fifty jobs needing a lathe for one cylinder-boring. Even the watchmaker, who used to use many special tools—mandrel, turns, Jacot tool, screw-head tool, rounding-up tool, etc., now tends to use a single well-equipped lathe for these various jobs.

I will conclude with a fairly obvious practical tip which may be useful. Anyone having to use a small tool, as one of the very cheap lathes of polishing-head type, or a fretsaw with inadequate drive—such as a sewing-machine stand—will much improve its

running by putting a small heavy flywheel on mandrel.

I had to execute some sawing the other day on a flimsy American fret machine, such as used to be sold for 17s. or 18s. It would only run jerkily till I clamped an old 3-in. scroll chuck weighing about 4 lbs. on the back end of mandrel, which enabled it to tackle the work without difficulty.—Yours, etc.,

R. W. BUTTNER.

DEAR SIR,—I feel that a vigorous reply is needed quickly to combat the negative state of mind exhibited by Mr. Dillon, otherwise, so powerful is example, harm may accrue to the cause.

By the time Mr. Dillon had read THE MODEL ENGINEER for fourteen years (and had made nothing), my chum and I were schoolboys noted chiefly for pronounced inquisitiveness. We each possessed a workshop (a small corner of a potting shed), and made such things as an aquarium, a flat-bottomed boat, a pair of house telephones, etc. For further work a lathe was clearly indicated—and our total pocket money was 9d. per week, with a very occasional shilling (perhaps). Direct purchase of a lathe being impossible, we "found" a sewing-machine treadle and built one. The bed, headstock, tailstock, etc., were wood, and the mandrel consisted of a bicycle spindler running in ball bearings with a lead pulley cast on. No, it did not have a compound slide-rest, screw-cutting and back-gear, nor a division-plate, but it had a faceplate—a piece of iron plate with a cycle nut "biffed" in. Anyhow, it revolved the work, which was, for us, an achievement. Now for some of its work: four wooden legs for a writing desk, parts for the house telephones, some small brass badges for our club, which, later on, we silver-plated, tool handles, a two-objective rose-piece for a microscope, repetition sawing for camera and microscope cases, a microscope turntable, etc.

If Mr. Dillon cares, he can get a Wade for about 40s. and make a treadle. The bench drill he mentions at 11s. 6d. is quite good for the money. After he had made a few things and sold them, he could purchase a scroll chuck and/or an independent four-jaw for about 30s. each, of an accuracy in keeping with the lathe.

One could keep on giving instructions, even quoting the case of Mr. Keniston who has made on a Wade lathe a replica of Mr. Lawrence's "Evergreen." But, having taken our horse to the water, would he drink? I wonder! No, I don't think Mr. Dillon wants a lathe, not really. Not yet, anyhow. First, he wants a course of Pelmanism to banish his fears and develop his "inner urge" or *ego libido*, as the psychologists say.

What is the good of a lathe, or anything else in this world, without that "inner urge"? Without that, one may as well be a cabbage.

And lest Mr. Dillon or anyone else should read unkindness in the foregoing, I may say that none is intended. I do feel real sorrow when I realise his tremendous loss of pleasure which comes from self-education and self-development, which generally start when we leave school, and never finish.—Yours faithfully,

F. H. HARMSWORTH.

Maidenhead.

Lathes for Universal Fine Work.

DEAR SIR,—I am pleased to see in your issue of January 24 last a reply to my letter regarding the above, especially coming as it does from a practical toolmaker of many years' standing.

But Mr. Adams concentrates chiefly on price, and although this is a factor in my letter, it is not by any means the most important. However, in this respect I fail to see why such a lathe as sold in 1907 cannot be produced at the same price, or even cheaper, to-day, having regard to the fact that engineering (or perhaps I should say machining) is done on very different lines to twenty years ago. You can buy better motor-cars with infinitely better workmanship for less than pre-war price to-day, as one instance.

With regard to the lathe, Mr. Adams' 1907 production was, I should think, a well-made tool, and far preferable to the cheap screw-cutting lathe of to-day, but the specification is not just what is required. The "gadgets" lathes to which he refers are expensive, because, as soon as one realises their "precision" abilities, they find their way to the "Sale and Exchange" columns, at least, mine did. One has occasion to do screw-cutting but very seldom, and with little experience and a makeshift kind of screw-cutting gear such as many lathes have it is practically impossible to be certain of the finished thread.

I should like to buy a well-made tool of 3½-in. centres, hollow mandrel without backgear, but with a large outside pulley like the "Exc" lathe (but detachable), and a three-step pulley in the usual place, properly ground and fitted headstock spindle, taper bearings, adjustable. Boring-table dead true to axis of centres, compound slide-rest, also properly fitted and adjustable for wear, and tailstock equally well fitted and in perfect alignment with mandrel centre.

If a good design were got out and submitted to THE MODEL ENGINEER for criticism, some idea could be gauged as to the possibility of marketing it, as I quite understand that quantity governs price to a big extent.—Yours, etc.,

E. H.

Guildford.

Small Channel and Angle In Brass or Steel.

DEAR SIR,—I wish to build a scale model of a crane, and for this purpose I required the following sections: ¼-in. by 3/16th-in., ½-in. by ¼-in. and ¾-in. by 3/16th-in. channel; ¼-in. by ¼-in. and ¾-in. by ¼-in. angle.

Can you please give me the name of any firm which could supply this type of material, either rolled or pressed? Meccano material is not suitable, as not being near enough to scale.—Yours faithfully,

F. J. NOLAN.

[We have sent our correspondent one or two addresses. He omits to say whether brass or steel is required. We shall be pleased to hear from any firms who can supply both or either, and will forward their letters to Mr. Nolan.—Ed., M.E.]

Foden Wagon Drawings.

SIR,—Could you through your columns get another reader to give me a dimensioned sketch of a Foden steam wagon, six-ton type, engine and boiler in front. I have worked on them, but, like many others, have come away without taking note of dimensions. I think the H.P. cylinder is about 8 ins., and L.P. about 12 ins., with wagon about 14 ft. long. A model 1½ ins. to 1 ft. would leave cylinders 1 in. and 1½ ins., but overall length 21 ins. would not leave much room on wagon body for seat when driving. Would a 1-in. and 1½-in. by 1½-in. stroke

carry a 12-stone person over, say, fair road surface at 90 lbs. per sq. in. This kind of model would do away with the need for tracks and a good-sized garden to lay them in.—Yours faithfully,

"NITRAM."

Gramophones: Overhauls and Repairs.

DEAR SIR,—I am interested in gramophones, and should like to point out that I think your correspondent, Mr. Bamford, has made an error regarding the tone-arm track. He suggests that the needle should be set at an angle of 60° and that the needle point should swing to the turn-table centre. This does not give correct needle track alignment and in every case the needle should rest *beyond* the spindle centre, and the face of the soundbox should be at an angle to the right of a straight line between the centre of the tone-arm bearing and the needle point. In the case of a 9-in. tone-arm, i.e., the distance between spindle centre and centre of tone-arm bearing, the needle point should rest about $\frac{1}{8}$ in. beyond the spindle and the sound-box face should lie at something like 23° to the right of the tone-arm centre. The above figures only relate to a 9-in. tone-arm, and they alter for different lengths of tone-arms.—Yours truly,

E. J. MACHIN.

INSTITUTIONS AND SOCIETIES.

The Society of Model and Experimental Engineers.

MEETINGS.—At Caxton Hall, Westminster, at 7 p.m. Tuesday, February 12, lecture by Flying Officer C. H. Latimer Needham, M.Sc., F.R.Ae.S., on "The Engineering Side of Aircraft Construction." Wednesday, March 6, Competition, Track and Model night. The attention of members is specially directed to the special competitions which are to be held on this evening. All members should have received a leaflet giving full particulars, enclosed in the 1929 handbook.

WORKSHOP.—Further demonstrations shortly. If you are not aware of what may be done with simple home-made milling cutters, come and see. You will have an agreeable surprise.

VISITS.—Mid-week visits to the headquarters of the B.B.C. and to the works of the L.G.O.C.; Saturday afternoon visit to Mr. S. W. Simpson at Brentwood.

Full particulars of the Society, together with forms of application for membership, may be obtained from the Secretary, R. W. WRIGHT, 202, Lavender Hill, Enfield, Middlesex, who will also be pleased to send a visitor's ticket for a meeting at the Caxton Hall or for the Society's Workshop.

Institute of Patentees.

The following new inventions have been received during the week ending January 26: A new or improved means of electro-depositing metals; improvements in or relating to retorts and furnaces; coin freed apparatus; improvements in stays for hinged doors; an improved motor headlight; improvements in shoes for horses and like animals; improvements in spring mattresses; single frame printer's composing and make-up case.

Secretary, G. DRURY COLEMAN, 39, Victoria Street, S.W.1.

West London Model Power Boat Club.

The annual general meeting was held on January 27, and attended in full strength. The balance-sheet showed that the financial position of the club was sound. Officers for the year were elected: Chairman, J. P. Oakley; Vice-Chairman, J. Gascoigne; Secretary, W. T. Parry; Messrs. W. Butler, P. Anderson and S. Haltrop were elected as committee. The Club has had a most successful year, and several new boats have left the stocks and others are building. Membership shows a steady increase.

It is hoped to hold regattas on the home water on the following dates: April 14, May 19, June 2, June 23 (grand regatta), July 21, October 29.

New members will be cordially welcomed by the Club. Application for membership should be made to the Hon. Secretary, W. THORNTON PARRY, 2A, Ennismore Gardens Mews N., S.W.7.

The Southampton Model Railway Club.

The activities of this club have been somewhat erratic owing to the state of affairs which usually accompany the start of a new club. However, matters are now progressing favourably. Despite its title the club *does not bar stationary engine and power boat enthusiasts*. We held a meeting on Saturday, January 19, and it was decided that the entrance fee be 2s. 6d., and a subsequent subscription of 2s. per month to be paid at the monthly meetings.

Hon. Secretary, C. CHEETHAM, 4, New Road, Southampton.

Notice.

The Editor invites correspondence and original contributions on all small power engineering, motor and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. It should be distinctly stated, when sending contributions, whether remuneration is expected, or not, and all MSS. should be accompanied by a stamped envelope addressed for return in the event of rejection. Readers desiring to see the Editor personally can only do so by making an appointment in advance.

All subscriptions and correspondence relating to sales of the paper and books to be addressed to Percival Marshall & Co., 66, Farringdon Street, London, E.C.4. Annual Subscription, £1 1s. 8d., post free to all parts of the world.

All correspondence relating to Advertisements and deposits to be addressed to THE ADVERTISEMENT MANAGER, "The Model Engineer," 66, Farringdon Street, London, E.C.4.

Sole Agents for United States, Canada and Mexico: Spon and Chamberlain, 120, Liberty Street, New York, U.S.A., to whom all subscriptions from these countries should be addressed. Single copies, 14 cents; annual subscription, 5 dollars 50 cents, post free.

Contents.

The asterisk (*) denotes that the subject is illustrated.

Smoke Rings	117
Fitting and Operating Michell Bearings	118
A model "Planet" Type Locomotive*	119
Shops, Shed and Road*	123
Workshop Topics*	127
Cutting a Rack for the Lathe by Hand*	131
New Tools and Supplies*	133
Vacancies for Aircraft Apprentices	134
For the Bookshelf	135
Model-Making in Australia*	136
Queries and Replies	137
Practical Letters from Our Readers	138
Institutions and Societies	140

The WREN TOOL CO.

METALS — TOOLS — SCREWS — SUNDRIES.

REPETITION MACHINE WORK. CASTINGS IN ALL METALS. PATTERN MAKING.
TERMS OF BUSINESS: STRICTLY CASH WITH ORDER. CARRIAGE OR POSTAGE EXTRA.

BRASS RODS, ROUND.—1/16", 1d.; 3/32", 1d.; 1/4", 1 1/2d.; 5/32", 2d.; 3/16", 2 1/2d.; 1/2", 3 1/2d.; 5/16", 5 1/2d.; 3/8", 6d.; 7/16", 8d.; 1/2", 9d.; 9/16", 1 1/4d.; 1 1/8", 1 5/8d.; 1 1/4", 1 7/8d.; 1 1/2", 2 1/8d.; 1 3/4", 2 5/8d.; 1 7/8", 3 1/8d.; 2", 3 3/4d.; 2 1/4", 4 1/4d.; 2 1/2", 4 7/8d.; 2 3/4", 5 1/2d.; 3", 5 7/8d.; 3 1/4", 6 1/4d.; 3 1/2", 6 7/8d.; 3 3/4", 7 1/4d.; 4", 7 7/8d.; 4 1/4", 8 1/4d.; 4 1/2", 8 7/8d.; 4 3/4", 9 1/4d.; 5", 9 7/8d.; 5 1/4", 10 1/4d.; 5 1/2", 10 7/8d.; 5 3/4", 11 1/4d.; 6", 11 7/8d.; 6 1/4", 12 1/4d.; 6 1/2", 12 7/8d.; 6 3/4", 13 1/4d.; 7", 13 7/8d.; 7 1/4", 14 1/4d.; 7 1/2", 14 7/8d.; 7 3/4", 15 1/4d.; 8", 15 7/8d.; 8 1/4", 16 1/4d.; 8 1/2", 16 7/8d.; 8 3/4", 17 1/4d.; 9", 17 7/8d.; 9 1/4", 18 1/4d.; 9 1/2", 18 7/8d.; 9 3/4", 19 1/4d.; 10", 19 7/8d.; 10 1/4", 20 1/4d.; 10 1/2", 20 7/8d.; 10 3/4", 21 1/4d.; 11", 21 7/8d.; 11 1/4", 22 1/4d.; 11 1/2", 22 7/8d.; 11 3/4", 23 1/4d.; 12", 23 7/8d.; 12 1/4", 24 1/4d.; 12 1/2", 24 7/8d.; 12 3/4", 25 1/4d.; 13", 25 7/8d.; 13 1/4", 26 1/4d.; 13 1/2", 26 7/8d.; 13 3/4", 27 1/4d.; 14", 27 7/8d.; 14 1/4", 28 1/4d.; 14 1/2", 28 7/8d.; 14 3/4", 29 1/4d.; 15", 29 7/8d.; 15 1/4", 30 1/4d.; 15 1/2", 30 7/8d.; 15 3/4", 31 1/4d.; 16", 31 7/8d.; 16 1/4", 32 1/4d.; 16 1/2", 32 7/8d.; 16 3/4", 33 1/4d.; 17", 33 7/8d.; 17 1/4", 34 1/4d.; 17 1/2", 34 7/8d.; 17 3/4", 35 1/4d.; 18", 35 7/8d.; 18 1/4", 36 1/4d.; 18 1/2", 36 7/8d.; 18 3/4", 37 1/4d.; 19", 37 7/8d.; 19 1/4", 38 1/4d.; 19 1/2", 38 7/8d.; 19 3/4", 39 1/4d.; 20", 39 7/8d.; 20 1/4", 40 1/4d.; 20 1/2", 40 7/8d.; 20 3/4", 41 1/4d.; 21", 41 7/8d.; 21 1/4", 42 1/4d.; 21 1/2", 42 7/8d.; 21 3/4", 43 1/4d.; 22", 43 7/8d.; 22 1/4", 44 1/4d.; 22 1/2", 44 7/8d.; 22 3/4", 45 1/4d.; 23", 45 7/8d.; 23 1/4", 46 1/4d.; 23 1/2", 46 7/8d.; 23 3/4", 47 1/4d.; 24", 47 7/8d.; 24 1/4", 48 1/4d.; 24 1/2", 48 7/8d.; 24 3/4", 49 1/4d.; 25", 49 7/8d.; 25 1/4", 50 1/4d.; 25 1/2", 50 7/8d.; 25 3/4", 51 1/4d.; 26", 51 7/8d.; 26 1/4", 52 1/4d.; 26 1/2", 52 7/8d.; 26 3/4", 53 1/4d.; 27", 53 7/8d.; 27 1/4", 54 1/4d.; 27 1/2", 54 7/8d.; 27 3/4", 55 1/4d.; 28", 55 7/8d.; 28 1/4", 56 1/4d.; 28 1/2", 56 7/8d.; 28 3/4", 57 1/4d.; 29", 57 7/8d.; 29 1/4", 58 1/4d.; 29 1/2", 58 7/8d.; 29 3/4", 59 1/4d.; 30", 59 7/8d.; 30 1/4", 60 1/4d.; 30 1/2", 60 7/8d.; 30 3/4", 61 1/4d.; 31", 61 7/8d.; 31 1/4", 62 1/4d.; 31 1/2", 62 7/8d.; 31 3/4", 63 1/4d.; 32", 63 7/8d.; 32 1/4", 64 1/4d.; 32 1/2", 64 7/8d.; 32 3/4", 65 1/4d.; 33", 65 7/8d.; 33 1/4", 66 1/4d.; 33 1/2", 66 7/8d.; 33 3/4", 67 1/4d.; 34", 67 7/8d.; 34 1/4", 68 1/4d.; 34 1/2", 68 7/8d.; 34 3/4", 69 1/4d.; 35", 69 7/8d.; 35 1/4", 70 1/4d.; 35 1/2", 70 7/8d.; 35 3/4", 71 1/4d.; 36", 71 7/8d.; 36 1/4", 72 1/4d.; 36 1/2", 72 7/8d.; 36 3/4", 73 1/4d.; 37", 73 7/8d.; 37 1/4", 74 1/4d.; 37 1/2", 74 7/8d.; 37 3/4", 75 1/4d.; 38", 75 7/8d.; 38 1/4", 76 1/4d.; 38 1/2", 76 7/8d.; 38 3/4", 77 1/4d.; 39", 77 7/8d.; 39 1/4", 78 1/4d.; 39 1/2", 78 7/8d.; 39 3/4", 79 1/4d.; 40", 79 7/8d.; 40 1/4", 80 1/4d.; 40 1/2", 80 7/8d.; 40 3/4", 81 1/4d.; 41", 81 7/8d.; 41 1/4", 82 1/4d.; 41 1/2", 82 7/8d.; 41 3/4", 83 1/4d.; 42", 83 7/8d.; 42 1/4", 84 1/4d.; 42 1/2", 84 7/8d.; 42 3/4", 85 1/4d.; 43", 85 7/8d.; 43 1/4", 86 1/4d.; 43 1/2", 86 7/8d.; 43 3/4", 87 1/4d.; 44", 87 7/8d.; 44 1/4", 88 1/4d.; 44 1/2", 88 7/8d.; 44 3/4", 89 1/4d.; 45", 89 7/8d.; 45 1/4", 90 1/4d.; 45 1/2", 90 7/8d.; 45 3/4", 91 1/4d.; 46", 91 7/8d.; 46 1/4", 92 1/4d.; 46 1/2", 92 7/8d.; 46 3/4", 93 1/4d.; 47", 93 7/8d.; 47 1/4", 94 1/4d.; 47 1/2", 94 7/8d.; 47 3/4", 95 1/4d.; 48", 95 7/8d.; 48 1/4", 96 1/4d.; 48 1/2", 96 7/8d.; 48 3/4", 97 1/4d.; 49", 97 7/8d.; 49 1/4", 98 1/4d.; 49 1/2", 98 7/8d.; 49 3/4", 99 1/4d.; 50", 99 7/8d.; 50 1/4", 100 1/4d.; 50 1/2", 100 7/8d.; 50 3/4", 101 1/4d.; 51", 101 7/8d.; 51 1/4", 102 1/4d.; 51 1/2", 102 7/8d.; 51 3/4", 103 1/4d.; 52", 103 7/8d.; 52 1/4", 104 1/4d.; 52 1/2", 104 7/8d.; 52 3/4", 105 1/4d.; 53", 105 7/8d.; 53 1/4", 106 1/4d.; 53 1/2", 106 7/8d.; 53 3/4", 107 1/4d.; 54", 107 7/8d.; 54 1/4", 108 1/4d.; 54 1/2", 108 7/8d.; 54 3/4", 109 1/4d.; 55", 109 7/8d.; 55 1/4", 110 1/4d.; 55 1/2", 110 7/8d.; 55 3/4", 111 1/4d.; 56", 111 7/8d.; 56 1/4", 112 1/4d.; 56 1/2", 112 7/8d.; 56 3/4", 113 1/4d.; 57", 113 7/8d.; 57 1/4", 114 1/4d.; 57 1/2", 114 7/8d.; 57 3/4", 115 1/4d.; 58", 115 7/8d.; 58 1/4", 116 1/4d.; 58 1/2", 116 7/8d.; 58 3/4", 117 1/4d.; 59", 117 7/8d.; 59 1/4", 118 1/4d.; 59 1/2", 118 7/8d.; 59 3/4", 119 1/4d.; 60", 119 7/8d.; 60 1/4", 120 1/4d.; 60 1/2", 120 7/8d.; 60 3/4", 121 1/4d.; 61", 121 7/8d.; 61 1/4", 122 1/4d.; 61 1/2", 122 7/8d.; 61 3/4", 123 1/4d.; 62", 123 7/8d.; 62 1/4", 124 1/4d.; 62 1/2", 124 7/8d.; 62 3/4", 125 1/4d.; 63", 125 7/8d.; 63 1/4", 126 1/4d.; 63 1/2", 126 7/8d.; 63 3/4", 127 1/4d.; 64", 127 7/8d.; 64 1/4", 128 1/4d.; 64 1/2", 128 7/8d.; 64 3/4", 129 1/4d.; 65", 129 7/8d.; 65 1/4", 130 1/4d.; 65 1/2", 130 7/8d.; 65 3/4", 131 1/4d.; 66", 131 7/8d.; 66 1/4", 132 1/4d.; 66 1/2", 132 7/8d.; 66 3/4", 133 1/4d.; 67", 133 7/8d.; 67 1/4", 134 1/4d.; 67 1/2", 134 7/8d.; 67 3/4", 135 1/4d.; 68", 135 7/8d.; 68 1/4", 136 1/4d.; 68 1/2", 136 7/8d.; 68 3/4", 137 1/4d.; 69", 137 7/8d.; 69 1/4", 138 1/4d.; 69 1/2", 138 7/8d.; 69 3/4", 139 1/4d.; 70", 139 7/8d.; 70 1/4", 140 1/4d.; 70 1/2", 140 7/8d.; 70 3/4", 141 1/4d.; 71", 141 7/8d.; 71 1/4", 142 1/4d.; 71 1/2", 142 7/8d.; 71 3/4", 143 1/4d.; 72", 143 7/8d.; 72 1/4", 144 1/4d.; 72 1/2", 144 7/8d.; 72 3/4", 145 1/4d.; 73", 145 7/8d.; 73 1/4", 146 1/4d.; 73 1/2", 146 7/8d.; 73 3/4", 147 1/4d.; 74", 147 7/8d.; 74 1/4", 148 1/4d.; 74 1/2", 148 7/8d.; 74 3/4", 149 1/4d.; 75", 149 7/8d.; 75 1/4", 150 1/4d.; 75 1/2", 150 7/8d.; 75 3/4", 151 1/4d.; 76", 151 7/8d.; 76 1/4", 152 1/4d.; 76 1/2", 152 7/8d.; 76 3/4", 153 1/4d.; 77", 153 7/8d.; 77 1/4", 154 1/4d.; 77 1/2", 154 7/8d.; 77 3/4", 155 1/4d.; 78", 155 7/8d.; 78 1/4", 156 1/4d.; 78 1/2", 156 7/8d.; 78 3/4", 157 1/4d.; 79", 157 7/8d.; 79 1/4", 158 1/4d.; 79 1/2", 158 7/8d.; 79 3/4", 159 1/4d.; 80", 159 7/8d.; 80 1/4", 160 1/4d.; 80 1/2", 160 7/8d.; 80 3/4", 161 1/4d.; 81", 161 7/8d.; 81 1/4", 162 1/4d.; 81 1/2", 162 7/8d.; 81 3/4", 163 1/4d.; 82", 163 7/8d.; 82 1/4", 164 1/4d.; 82 1/2", 164 7/8d.; 82 3/4", 165 1/4d.; 83", 165 7/8d.; 83 1/4", 166 1/4d.; 83 1/2", 166 7/8d.; 83 3/4", 167 1/4d.; 84", 167 7/8d.; 84 1/4", 168 1/4d.; 84 1/2", 168 7/8d.; 84 3/4", 169 1/4d.; 85", 169 7/8d.; 85 1/4", 170 1/4d.; 85 1/2", 170 7/8d.; 85 3/4", 171 1/4d.; 86", 171 7/8d.; 86 1/4", 172 1/4d.; 86 1/2", 172 7/8d.; 86 3/4", 173 1/4d.; 87", 173 7/8d.; 87 1/4", 174 1/4d.; 87 1/2", 174 7/8d.; 87 3/4", 175 1/4d.; 88", 175 7/8d.; 88 1/4", 176 1/4d.; 88 1/2", 176 7/8d.; 88 3/4", 177 1/4d.; 89", 177 7/8d.; 89 1/4", 178 1/4d.; 89 1/2", 178 7/8d.; 89 3/4", 179 1/4d.; 90", 179 7/8d.; 90 1/4", 180 1/4d.; 90 1/2", 180 7/8d.; 90 3/4", 181 1/4d.; 91", 181 7/8d.; 91 1/4", 182 1/4d.; 91 1/2", 182 7/8d.; 91 3/4", 183 1/4d.; 92", 183 7/8d.; 92 1/4", 184 1/4d.; 92 1/2", 184 7/8d.; 92 3/4", 185 1/4d.; 93", 185 7/8d.; 93 1/4", 186 1/4d.; 93 1/2", 186 7/8d.; 93 3/4", 187 1/4d.; 94", 187 7/8d.; 94 1/4", 188 1/4d.; 94 1/2", 188 7/8d.; 94 3/4", 189 1/4d.; 95", 189 7/8d.; 95 1/4", 190 1/4d.; 95 1/2", 190 7/8d.; 95 3/4", 191 1/4d.; 96", 191 7/8d.; 96 1/4", 192 1/4d.; 96 1/2", 192 7/8d.; 96 3/4", 193 1/4d.; 97", 193 7/8d.; 97 1/4", 194 1/4d.; 97 1/2", 194 7/8d.; 97 3/4", 195 1/4d.; 98", 195 7/8d.; 98 1/4", 196 1/4d.; 98 1/2", 196 7/8d.; 98 3/4", 197 1/4d.; 99", 197 7/8d.; 99 1/4", 198 1/4d.; 99 1/2", 198 7/8d.; 99 3/4", 199 1/4d.; 100", 199 7/8d.; 100 1/4", 200 1/4d.; 100 1/2", 200 7/8d.; 100 3/4", 201 1/4d.; 101", 201 7/8d.; 101 1/4", 202 1/4d.; 101 1/2", 202 7/8d.; 101 3/4", 203 1/4d.; 102", 203 7/8d.; 102 1/4", 204 1/4d.; 102 1/2", 204 7/8d.; 102 3/4", 205 1/4d.; 103", 205 7/8d.; 103 1/4", 206 1/4d.; 103 1/2", 206 7/8d.; 103 3/4", 207 1/4d.; 104", 207 7/8d.; 104 1/4", 208 1/4d.; 104 1/2", 208 7/8d.; 104 3/4", 209 1/4d.; 105", 209 7/8d.; 105 1/4", 210 1/4d.; 105 1/2", 210 7/8d.; 105 3/4", 211 1/4d.; 106", 211 7/8d.; 106 1/4", 212 1/4d.; 106 1/2", 212 7/8d.; 106 3/4", 213 1/4d.; 107", 213 7/8d.; 107 1/4", 214 1/4d.; 107 1/2", 214 7/8d.; 107 3/4", 215 1/4d.; 108", 215 7/8d.; 108 1/4", 216 1/4d.; 108 1/2", 216 7/8d.; 108 3/4", 217 1/4d.; 109", 217 7/8d.; 109 1/4", 218 1/4d.; 109 1/2", 218 7/8d.; 109 3/4", 219 1/4d.; 110", 219 7/8d.; 110 1/4", 220 1/4d.; 110 1/2", 220 7/8d.; 110 3/4", 221 1/4d.; 111", 221 7/8d.; 111 1/4", 222 1/4d.; 111 1/2", 222 7/8d.; 111 3/4", 223 1/4d.; 112", 223 7/8d.; 112 1/4", 224 1/4d.; 112 1/2", 224 7/8d.; 112 3/4", 225 1/4d.; 113", 225 7/8d.; 113 1/4", 226 1/4d.; 113 1/2", 226 7/8d.; 113 3/4", 227 1/4d.; 114", 227 7/8d.; 114 1/4", 228 1/4d.; 114 1/2", 228 7/8d.; 114 3/4", 229 1/4d.; 115", 229 7/8d.; 115 1/4", 230 1/4d.; 115 1/2", 230 7/8d.; 115 3/4", 231 1/4d.; 116", 231 7/8d.; 116 1/4", 232 1/4d.; 116 1/2", 232 7/8d.; 116 3/4", 233 1/4d.; 117", 233 7/8d.; 117 1/4", 234 1/4d.; 117 1/2", 234 7/8d.; 117 3/4", 235 1/4d.; 118", 235 7/8d.; 118 1/4", 236 1/4d.; 118 1/2", 236 7/8d.; 118 3/4", 237 1/4d.; 119", 237 7/8d.; 119 1/4", 238 1/4d.; 119 1/2", 238 7/8d.; 119 3/4", 239 1/4d.; 120", 239 7/8d.; 120 1/4", 240 1/4d.; 120 1/2", 240 7/8d.; 120 3/4", 241 1/4d.; 121", 241 7/8d.; 121 1/4", 242 1/4d.; 121 1/2", 242 7/8d.; 121 3/4", 243 1/4d.; 122", 243 7/8d.; 122 1/4", 244 1/4d.; 122 1/2", 244 7/8d.; 122 3/4", 245 1/4d.; 123", 245 7/8d.; 123 1/4", 246 1/4d.; 123 1/2", 246 7/8d.; 123 3/4", 247 1/4d.; 124", 247 7/8d.; 124 1/4", 248 1/4d.; 124 1/2", 248 7/8d.; 124 3/4", 249 1/4d.; 125", 249 7/8d.; 125 1/4", 250 1/4d.; 125 1/2", 250 7/8d.; 125 3/4", 251 1/4d.; 126", 251 7/8d.; 126 1/4", 252 1/4d.; 126 1/2", 252 7/8d.; 126 3/4", 253 1/4d.; 127", 253 7/8d.; 127 1/4", 254 1/4d.; 127 1/2", 254 7/8d.; 127 3/4", 255 1/4d.; 128", 255 7/8d.; 128 1/4", 256 1/4d.; 128 1/2", 256 7/8d.; 128 3/4", 257 1/4d.; 129", 257 7/8d.; 129 1/4", 258 1/4d.; 129 1/2", 258 7/8d.; 129 3/4", 259 1/4d.; 130", 259 7/8d.; 130 1/4", 260 1/4d.; 130 1/2", 260 7/8d.; 130 3/4", 261 1/4d.; 131", 261 7/8d.; 131 1/4", 262 1/4d.; 131 1/2", 262 7/8d.; 131 3/4", 263 1/4d.; 132", 263 7/8d.; 132 1/4", 264 1/4d.; 132 1/2", 264 7/8d.; 132 3/4", 265 1/4d.; 133", 265 7/8d.; 133 1/4", 266 1/4d.; 133 1/2", 266 7/8d.; 133 3/4", 267 1/4d.; 134", 267 7/8d.; 134 1/4", 268 1/4d.; 134 1/2", 268 7/8d.; 134 3/4", 269 1/4d.; 135", 269 7/8d.; 135 1/4", 270 1/4d.; 135 1/2", 270 7/8d.; 135 3/4", 271 1/4d.; 136", 271 7/8d.; 136 1/4", 272 1/4d.; 136 1/2", 272 7/8d.; 136 3/4", 273 1/4d.; 137", 273 7/8d.; 137 1/4", 274 1/4d.; 137 1/2", 274 7/8d.; 137 3/4", 275 1/4d.; 138", 275 7/8d.; 138 1/4", 276 1/4d.; 138 1/2", 276 7/8d.; 138 3/4", 277 1/4d.; 139", 277 7/8d.; 139 1/4", 278 1/4d.; 139 1/2", 278 7/8d.; 139 3/4", 279 1/4d.; 140", 279 7/8d.; 140 1/4", 280 1/4d.; 140 1/2", 280 7/8d.; 140 3/4", 281 1/4d.; 141", 281 7/8d.; 141 1/4", 282 1/4d.; 141 1/2", 282 7/8d.; 141 3/4", 283 1/4d.; 142", 283 7/8d.; 142 1/4", 284 1/4d.; 142 1/2", 284 7/8d.; 142 3/4", 285 1/4d.; 143", 285 7/8d.; 143 1/4", 286 1/4d.; 143 1/2", 286 7/8d.; 143 3/4", 287 1/4d.; 144", 287 7/8d.; 144 1/4", 288 1/4d.; 144 1/2", 288 7/8d.; 144 3/4", 289 1/4d.; 145", 289 7/8d.; 145 1/4", 290 1/4d.; 145 1/2", 290 7/8d.; 145 3/4", 291 1/4d.; 146", 291 7/8d.; 146 1/4", 292 1/4d.; 146 1/2", 292 7/8d.; 146 3/4", 293 1/4d.; 147", 293 7/8d.; 147 1/4", 294 1/4d.; 147 1/2", 294 7/8d.; 147 3/4", 295 1/4d.; 148", 295 7/8d.; 148 1/4", 296 1/4d.; 148 1/2", 296 7/8d.; 148 3/4", 297 1/4d.; 149", 297 7/8d.; 149 1/4", 298 1/4d.; 149 1/2", 298 7/8d.; 149 3/4", 299 1/4d.; 150", 299 7/8d.; 150 1/4", 300 1/4d.; 150 1/2", 300 7/8d.; 150 3/4", 301 1/4d.; 151", 301 7/8d.; 151 1/4", 302 1/4d.; 151 1/2", 302 7/8d.; 151 3/4", 303 1/4d.; 152", 303 7/8d.; 152 1/4", 304 1/4d.; 152 1/2", 304 7/8d.; 152 3/4", 305 1/4d.; 153", 305 7/8d.; 153 1/4", 306 1/4d.; 153 1/2", 306 7/8d.; 153 3/4", 307 1/4d.; 154", 307 7/8d.; 154 1/4", 308 1/4d.; 154 1/2", 308 7/8d.; 154 3/4", 309 1/4d.; 155", 309 7/8d.; 155 1/4", 310 1/4d.; 155 1/2", 310 7/8d.; 155 3/4", 311 1/4d.; 156", 311 7/8d.; 156 1/4", 312 1/4d.; 156 1/2", 312 7/8d.; 156 3/4", 313 1/4d.; 157", 313 7/8d.; 157 1/4", 314 1/4d.; 157 1/2", 314 7/8d.; 157 3/4", 315 1/4d.; 158", 315 7/8d.; 158 1/4", 316 1/4d.; 158 1/2", 316 7/8d.; 158 3/4", 317 1/4d.; 159", 317 7/8d.; 159 1/4", 318 1/4d.; 159 1/2", 318 7/8d.; 159 3/4", 319 1/4d.; 160", 319 7/8d.; 160 1/4", 320 1/4d.; 160 1/2", 320 7/8d.; 160 3/4", 321 1/4d.; 161", 321 7/8d.; 161 1/4", 322 1/4d.; 161 1/2", 322 7/8d.; 161 3/4", 323 1/4d.; 162", 323 7/8d.; 162 1/4", 324 1/4d.; 162 1/2", 324 7/8d.; 162 3/4", 325 1/4d.; 163", 325 7/8d.; 163 1/4", 326 1/4d.; 163 1/2", 326 7/8d.; 163 3/4", 327 1/4d.; 164", 327 7/8d.; 164 1/4", 328 1/4d.; 164 1/2", 328 7/8d.; 164 3/4", 329 1/4d.; 165", 329 7/8d.; 165 1/4", 330 1/4d.; 165 1/2", 330 7/8d.; 165 3/4", 331 1/4d.; 166", 331 7/8d.; 166 1/4", 332 1/4d.; 166 1/2", 332 7/8d.; 166 3/4", 333 1/4d.; 167", 333 7/8d.; 167 1/4", 334 1/4d.; 167 1/2", 334 7/8d.; 167 3/4", 335 1/4d.; 168", 335 7/8d.; 168 1/4", 336 1/4d.; 168 1/2", 336 7/8d.; 168 3/4", 337 1/4d.; 169", 337 7/8d.; 169 1/4", 338 1/4d.; 169 1/2", 338 7/8d.; 169 3/4", 339 1/4d.; 170", 339 7/8d.; 170 1/4", 340 1/4d.; 170 1/2", 340 7/8d.; 170 3/4", 341 1/4d.; 171", 341 7/8d.; 171 1/4", 342 1/4d.; 171 1/2", 342 7/8d.; 171 3/4", 343 1/4d.; 172", 343 7/8d.; 172 1/4", 344 1/4d.; 172 1/2", 344 7/8d.; 172 3/4", 345 1/4d.; 173", 345 7/8d.; 173 1/4", 346 1/4d.; 173 1/2", 346 7/8d.; 173 3/4", 347 1/4d.; 174", 347 7/8d.; 174 1/4", 348 1/4d.; 174 1/2", 348 7/8d.; 174 3/4", 349 1/4d.; 175", 349 7/8d.; 175 1/4", 350 1/4d.; 175 1/2", 350 7/8d.; 175 3/4", 351 1/4d

SALES AND WANTS

EVERYBODY'S MARKET

ENGINEERING ELECTRICAL & SCIENTIFIC GOODS

Advertisements are inserted in these columns at the rate of One Penny per word; minimum charge for advertisement, One Shilling. Single letters or figures are charged as words, and a compound word as two words. The advertiser's name and address are charged for.

Advertisers who wish to separate their announcements into distinct paragraphs must have not less than 12 words in any one paragraph, followed by the word "Below"—which is charged for.

"Box" Replies care of these offices, are charged 6d. extra to cover postage. The following words must appear at end of advertisement: "Box —, 'Model Engineer' Offices," for which usual rate will be charged. (Advertisers need not include our full address.) When replying to a "Box No." advt. address your envelope: Advertiser, Box —, "The Model Engineer," 66, Farringdon Street, London, E.C.4.

All advertisements in these columns must be prepaid, and remittances should be made by Postal Orders or Stamps, and sent to the Advertisement Manager, "The Model Engineer," 66, Farringdon Street, London, E.C.4.

Please state under which Classified Heading you wish your advertisement to appear; the classifications are as follows:—

General, Models, Wireless, Motoring.
Tools, Engines, Electrical, Business, Wanted.

Advertisers are requested to send in their announcements as early in the week as possible, as although we accept advertisements up till the first post on Friday preceding the date of issue, we cannot guarantee the insertion of those arriving on this day. Telephone: Central 9071.

OUR DEPOSIT SYSTEM.

We will receive from intending purchasers the purchase money of any article advertised or sold by our advertisers, and will acknowledge its receipt to both the Depositor and the Vendor, whose full names and addresses must be given. Unless otherwise arranged beforehand between the parties, it is understood that all goods are sent on approval, and that each person pays carriage one way if the goods are returned. The deposit is retained by us until we are advised of the completion of the purchase, or of the articles having been returned and accepted. In addition to the amount of the deposit, a fee of 1/- for the sum of £1 and under, and 1/6 for amounts in excess of £1, to cover postage, etc., must be remitted at the same time, and sent to the Advertisement Manager, "The Model Engineer," 66, Farringdon Street, London, E.C.4. In cases of persons not resident within the United Kingdom, double fees are charged.

The amount of the deposit must be sent either by Postal Order or Registered Letter. (Cheques cannot be accepted.)

The fee mentioned above should be sent in Stamps or by Postal Order as a separate amount.

In cases of exchange, money to the value of the article should be deposited by each party. We cannot receive the articles themselves.



Watch Jobbers.—List Tools, Material, Watches, Clocks and Gramophone Parts. Guaranteed repairs. All parcels fully insured. Our 5s. box of Watch Parts saves pounds. Sample 1s.—BLAKISTON, Ainsdale, Lancs.

B.A. Screws, Nuts, Washers, assorted gross 2s., list 2d.; small Whitworth Screws, assorted gross, brass 3s., steel 2s. 6d.; trade supplied.—J. H. BENNETT, Station Road, Willesden Junction.

Mechanics' Overalls at Pre-War Prices. 2s. 11d., strong blue or brown drill. Washing and wear guaranteed. Direct from factory at makers' prices. A p.c. brings patterns, inch tape and self-measurement chart.—CURREY & Co. (Dept. E.), 9, John Street, Thomas Street, Manchester.

Oxy-Acetylene Welding Pays!!—"Ajax" Plants soon return costs.—GREENWOOD, Arnsdale Road, Southampton.

1,000 Billheads, 4s. 6d.; all Printing cheap; samples free.—ECONOMIC PRESS, Branksome, Bournemouth.

Surveyor's Prismatic Compasses, two, by Hicks, 2½", with card dials, in sling leather cases, 12s. 6d. each.—GENTRY, 66, Farringdon Street, London, E.C.4.

Rare "Model Engineer" Volumes, going at less than present market price: Vol. I, £3; Vol. II, £2; Vol. III, £1 10s.; or £6 the set, carriage paid; all perfectly new, and in publishers' bindings; a great opportunity to acquire earliest numbers. Apply without delay, please.—Below.

"Model Railway News" Volumes. Vol. 1 (very rare), 25s.; Vol. 2, 7s. 6d.; or 30s. both. Perfectly new condition, publishers' bindings. London district.—Write, Box 1135, MODEL ENGINEER OFFICES.

Cheap Printings.—1,000 Billheads, 3s. 6d.; samples free.—CRETEWAY PRESS (22), Buxted, Sussex.

Repairs, Electrical (A.C. or D.C.) or Mechanical, large or small; best workmanship; reasonable charges.—SALLIS, Mayfield Grove, Nottingham.

Free.—Pocket Rubber Stamp of your Name and Address; also particulars of Money-making Spare Time Work.—H. RICHARD, Snow Hill, London.

Prompt Repairs (or spare parts supplied) to Watches, Clocks, Jewellery, Optics, Gramophones. Wheel-cutting undertaken. Price Lists: New Watches, Clocks and Cutlery, 6d.; Repair Charges, 3d.; Material and Tool Catalogue, 1s. 9d. (overseas excluded).—YOUNG & SON, Material Dealers, Chippenham, Wilts.

Firth's Stainless Steel.—Bright Sheet, 1/32" 3s. 6d., 1/16" 6s. 2d., 3/32" 8s. 1d. per sq. ft. Round Rod, 3/16" 3d., 1/4" 4d., 5/16" 7d., 3/8" 9d., 7/16" 1s., 1/2" 1s. 2d., 5/8" 1s. 6d., 3/4" 2s. 8d., 1" 4s. 8d. per ft.; postage extra. Other sections and sizes quoted for.—CAYTON BAY GARAGE, Scarborough.

New 1-ton Garage Crane, 9 ft.; new Cossor Melody Maker, £6; Super Het. Kit, 50s.; Marconi Eliminator, Valves, etc., cheap; all new; exchanges.—REVELL, Engineer, Great Clacton, Essex.

When communicating

—with Advertisers our readers will avoid delay if they will kindly state requirements clearly —whether ordering goods or merely sending an inquiry. A stamp should be enclosed when asking for lists or particulars.

Vices, Parkinson's "Handy," width 2½", 8s. 6d.; Grinders, hand, "Midget," 2½", 4s.; Pressure Pumps, 7×14", 1s. 4d.—Below.

Wire Strainers, aero steel, small, doz. 1s. 6d.; Aero Thermometers, dashboard, 10s. 6d.; Trench Periscopes, complete, cased, 2s. 3d.—Below.

Leather Helmets, new fleecy lined, 4s. 9d.; Cross Levels, 1s. 6d.; Wrist Altimeters, with strap, 17s.—Below.

Hand Drills, single, ¾", 3s. 6d.; Hydrometers, glass, various ranges, 9d.; Accumulators, 2 volts 13 amps., non-spillable, chloride, 4s. 6d.—Below.

Spirit Levels, 10×2", 2s. 3d.; Throttle Controls Tamper, 2s. 3d.; Bolts, Nuts, Washers, ex-aero, unused, 7lb. bag 4s. Above postage paid. Send for free list Tools, Ball Races, Instruments, etc.—COLEY, LTD., Ordnance Works, Queen Elizabeth Road, Kingston-on-Thames. (Phone 0365.)

Transfers for all purposes. Wood inlay, floral, Dutch, Japanese, birds, trade signs. Selection any kind, 1s. 6d. Illustrated catalogue 3d.—Below.

Cycle Lining Transfers, self-fixing. All usual colours. Easiest to apply. 10d. and 1s. set. Sample 2d.—Below.

Doll's House Brickpapers, Wallpapers, etc. Samples 2d.—E. R. AXON-HARRISON, Jersey.

Enlarge Your Drawings Mechanically with a "Perfect" Pantograph. Oak, brass fittings. Boxed with instructions. Approval 2s. 6d.—INDUSTRIES, 13, Gordon Avenue, Twickenham.

Metal Casting Moulds, for lead soldiers, farmyard animals, etc. List, stamp. Sample mould 3s. 6d.—INDUSTRIES, 13, Gordon Avenue, Twickenham.

"Torque" Round Belting and Fasteners, for lathes, etc. Adjustable for tension. Belting 5/16" diam., 3d. ft.; Fasteners, 8d. per set; ¼", 2d.; Fasteners 7d., fitted. State working tension length required for fitting. All sizes and lengths from 3/16" to ½" diam.—Below.

Sash Cords, very durable, will outlast all others. 8-yard hanks 2s. 6d.—CHEELD BROS., Engineers, Clacton, Essex.

£1 Worth of Taps, 6s.: 30, consisting ¾", 5/16", 9/32", ¼" B.S.F., 2 B.A., 4 B.A., R. & L., remainder Whitworth, Gas and Metric; all new; best makes; postage 6d.; approval willingly. Twelve Assorted Round Dies up to ¼", 6s., new; postage 4d.—Below.

Bright Hex. Steel Bolts, ¾" (B.S.F.), 3/16" (2 B.A.), ¼" (4 B.A.), 1" to 5" long, 3 gross assorted 5s., post free.—Below.

Bright Hex. Steel Bolts, Nuts and Studs, new, but slightly store-soiled, useful assortment to ¾" diam., £1 cwt., free on rail; sample 10 lb., 3s. 6d., post free.—Below.

Bright Steel Eye-Bolts, assorted to ¾" diam., 5s. post free.—MARCHANT, Tiptree, Essex.

Gas Engine, 3 h.p.; Petrol Motor, ½ h.p.; Steam Boilers, many excellent models, etc.; Contents of Amateur Workshop; 53 well-bound Volumes MODEL ENGINEER, January, 1928, to December, 1925; others loose to August, 1925. Offer.—Write, Box X.E., c/o DAVIES, 95, Bishopsgate, E.C.2.

Stop Worrying about your soldering jobs. Buy a tin of "Soldron" to-day; 6d. per tin, post 11d. Trade enquiries invited.—BUSBRIDGE, Amersham Road, High Wycombe.

"General"—(Contd.)

Aluminium Soldering—A Paying Hobby. "Vic-sol" gives guaranteed results. Low melting point. Sample 1s. 6d. Complete outfit 4s. 6d.—WESTERN ACCESSORIES, Sticklepath, Okehampton.

Whitworth, B.S.F., B.A. Nuts, Bolts, Washers, Wood-screws, Drills, Reamers, Files, Taps, Dies, Vices, Cotter, Tapers. Bargain list free.—COTES, Old Palace Yard, Richmond, Surrey.

Bookbinding.—We supply Official Publishers' Cover and bind your parts with strong cloth joints. Returned carriage paid for 4s. 6d.—WILLS, Bookbinder, 123-125, Church Street, Croydon.

Cassell's "Book of Knowledge," comprising eight volumes, splendidly bound in blue cloth with heavy gilt lettering and design on end. Profusely illustrated throughout. In absolutely new condition, never been read; bargain £4 10s., carriage paid.—P. SCANLON, 70, Gloucester Road, Higham Hill, London E.17.

"Erinold." Artificial Ivory in 300 colours. Turns beautifully. Sample parcels on approval. Particulars given, stamp.—PAIN, 43, Desborough Street, High Wycombe.

Exchange "Denbigh" Bench Drilling Machine, No. 1 Morse taper, for good Motor Starter, ½ h.p. A.C.—BRIDGE, 32, Gower Road, Hyde, Cheshire.

"Iron-Steel-Cement," repairs wrought or cast iron, leaky water jackets and boilers, cracked cylinders and parts. Withstands fire; expands and contracts. Sets hard like metal itself, without heat. Tins 1s. 3d., 2s. 6d., 4s. 6d., 7s. 6d., posted.—ALBERT FEATHER, White Abbey Road, Bradford, Yorkshire.

Ford Starter Motor, new, 30s. or exchange Motor Cycle or Wireless and 6-volt Starter Battery.—112, Middle Street, Deal, Kent.

½ h.p. Polishing Motor, 50s.: 150 Voltmeter, 4s.; 1 h.p. Motor, no armature, 30s.: Hand Press, 5s.; quantity Wood Pulleys.—BELLMAN, 67, Aston Street, Birmingham.

Lighting-Charging Plant.—½ 1 h.p. engine, governed, magneto, fittings, accessories, for gas, petrol, paraffin, dynamo 37 volts 6-10 amps., ring oilers, carbon brushes, shunt, slate switch-board 15" x 15", meters, cut-out, battery, switches, etc., £12 or offer; Dynamo, 15 volts 10 amps., 25s.; 25-volt 6-amp. Semi-enclosed Armature, requires winding, 12s. 6d.; Charging Resistance, 7s. 6d.; new 4" Meters, 0-40 volts, 0-10 amps., 10s.; 2" Ammeters, 0-20-0-20, 0-15, 2" Voltmeters, 0-15, 4s.; V.C.F. Boiler, 4" x 8", all fittings, 12s. 6d.; Vertical Marine Engine, 1" x 1", 12s. 6d.; Horizontal Engine Parts, 1" x 1", 7s. 6d.; Launch Engine, 1" x 1", 3s. 6d.; Dynamo Castings, 60 watts, 3s. 6d.; 12 ft. x 1" Shafting, 3s. 6d.; 1" Coupling, 4s.; six 1" Plummer Blocks, 10s.; 5 Wall Brackets, 1", 10s.; 1" J" Hanger, 2s. 6d.; Pulleys, 12" x 1" x 1", vee split, 5s.; 10" x 2" x 1", 3s. 6d.; 8" x 2" x 1", 3s.; 6" x 2" x 1", 2s. 6d.; 18 ft. x 14" Belting, 3s.; 16 ft. x 14", 4s.; all new; two 1" Plummer Blocks, 3s.; offers; particulars, stamp.—W. GARWOOD, 68, Cavendish Street, Ipswich.

For Sale.—Pathoscope Cinematograph, complete, in portable case, with three films and four spools, dynamo lighting, condition perfect; seen by appointment; £4 15s., or exchange Corona Portable Typewriter.—DYKE, 125, Waterloo Road, Uxbridge.

Is. Any Lot, Post Free.—2 Left-hand Circular Dies, 3" and 5/16"; 3 Dies, 3, 4, 4 mm.; 6 Taps to correspond; 20 small Drills; 12 larger Drills; 4 Assorted Grinding Wheels; 144 Whitworth and B.A. Nuts; 36 Assorted Chuck and other Springs; 2 Slotting Cutters; 12 ft. Silver Steel; 12 Hack Saw Blades; 2 Reamers.—BROOK'S, Engineers, Poulton-le-Fylde.

Remington No. 7 Typewriter, splendid condition, bargain 55s. The last one! "Write Easy" Typewriter, brand new, in metal carrying case, only 45s.—200, Church Road, Willesden.

Exceptional Bargains at Gift Prices 1s.—"Salter" Typewriter, perfect working order, every figure and letter perfect, in case, 30s.; 220-50-volt Electric Radiator, 2 kw., perfect, 10s.; brand new 4-guinea "Mozart" Portable Gramophone, present at Xmas, £2; Crompton Voltmeter to 80 and Ammeter to 100, perfect, 6s. dials, 10s. each; No. 1 Flypress, will press out all sorts of metal fittings, perfect, £1; slightly used 12-guinea "Sun Ray" Health Lamp, perfect, a great tonic, £3, with full instructions; stamp, appointment.—HOOD, "Lido," Ridgeview Road, N.20.

Home Cinematography.

Cinematograph Films and cheap British-made Machines, Accessories; list free—"FILMERIFS," 57, Lancaster Road, Leytonstone, London.

"Working Your Home Cinema." Valuable information. Also bargain lists Standard Films Postage 2d.—"WAYLAND," 109, Kenlor, Tooting, London.

Professional Empire Cinematograph, complete, £12; Home Professional Machine, 50s.; Films.—NEWTON, 123, Cleveland Street, London, W.

Films.—Features, Comedies, Interest, Coloured, Cartoons, Travel, etc. Large selection. Stamp for lists.—TURNER, 82, Dorothy Road, Leicester.



Boilers in Steel or Copper, all types and sizes; Locomotive Boilers from 1/4" scale made to fit your frames, flanged plates; supplied copper or steel.—GOODHARD, Marlborough Road, Gillingham, Kent.

Model Yachts. Build your own. Complete Set of Parts, 5s. Send 2d. stamps for plan and full instructions.—CAPRI MODEL YACHT WORKS, Church Walks, Llandudno.

Vertical Boiler, 10" x 5", centrifuge and gas ring; Stuart Vertical Engine; £2.—F. BODIN, 13, Firs Street, Dudley.

Gauge 1 Electric Loco, wagons, track; ½ h.p. Stuart Gas Engine; Dynamo.—29, Reed Pond Walk, Gidea Park.

Our Deposit System—

is run specially for *Your* benefit when dealing with strangers—whether buying or selling. The fee for this safeguard is trifling—full particulars are given at head of "SALES AND WANTS" section.

"L.B.S.C." "Minnehaha" Frames, marked for cutting, complete with buffer beam, 3s., post free. All materials supplied.—WALTON, 85, Lilyhill Street, Whitefield, Manchester.

Stuart Triple-expansion Engine Castings, cylinders bored and faced, complete set; highest cash offer.—POOLE, 7, Ravensworth Terrace, Burnham-on-Sea, Somerset.

Bargain Lot, £4 10s. or nearest for cash.—Two full-size Drawings 2-6-0 Southern Railway Express Loco; Part-finished 2-6-0 Southern Loco in 1 1/2" gauge, and raw materials to complete same; Finished Parts pair of special Cylinders and all Scale Flanged Cast Iron Wheels, with axles. Reason for selling—no spare time to complete.—"Doug," 98, High Street, Barnstable.

Gauge 0.—Scale Model Clockwork L.M.S. 2-6-0 "Mogul" Loco and Tender, No. 13000, by Bassett-Lowke, perfect condition, £3 15s.; Stuart "Simplex" Steam Engine, with displacement lubricator, very little used, £1.—J. TURNER, 36, Commercial Road, Lambeth, London, S.E.1.

2" x 3" Horizontal Steam Engine, on large mahogany base, working order, £1.—NICHOLS, "Booldana," Tuffey Avenue, Gloucester.

1 1/2" Scale Bassett-Lowke Loco and Tender, practically brand new, cost £260, will accept best offer.—Box 1159, MODEL ENGINEER OFFICES.

Complete Gauge 1 Scale Railway, consisting of 8 locos, 16 wooden coaches, 12 tinplate bogie coaches, 40 assorted wagons, 300 ft. of track, points, stations, buildings, etc., majority Bassett-Lowke goods, sacrifice £75, or will sell separately.—Below.

1/2" Scale 4-6-0 "Sir Sam Fay," with 7 super detail wooden coaches (interior fittings); reasonable offer.—Box 1160, MODEL ENGINEER OFFICES.

V. Taylor, 218, Gloucester Road, West Croydon, for accurate model, experimental and instrument work. Inquiries invited.

Hornby Metro Electric Train Set, nearly new 2 Pullman cars, rails, resistance, etc., gift 95s.—200, Church Road, Willesden.

A Magnificent Model Railway, 1 1/2" gauge, comprising engines, coaches, etc., etc., late property of millionaire's son; supplied by Bassett-Lowke; cost over £80; splendid condition, £15; appointment.—22, Caddington Road, Cicklewood, N.W.2.

Paraffin Burners.—The new Hood Burner for locos, boats; also for all your silver-soldering jobs. Size 2 1/2" long, 1 1/2" wide, 2" high. Makes your loco pull like a tractor. If tired of coal, try this. Guaranteed more powerful than "Carson" type. Complete burner, with chokeless nipple, 5s. 9d., postage 4d.—"Lido," Ridgeview Road, N.20.



Loud-speakers.—Fuller Sparta "Junior," 55s. model, brand new and guaranteed, bankrupt stock, clearing at 21s. each; 7 days' approval allowed against cash.—MAUDS, 58, Praed Street, W.

Accumulators, best quality, cheapest anywhere.—HAYNES, rear 847, Old Kent Road, S.E.15.

Loud-speakers.—Have you ever heard the roll of the drums on your old horn speaker? Here is a speaker that has a full range of tone from the deep pedal of the organ to the highest note of the piccolo. This marvellous reproduction is only rivalled by the moving coil speaker. Specification includes cabinet, 14" x 14" x 7", in solid oak or mahogany, incorporating a 4-pole balanced armature unit, and specially treated free edge cone. The great demand for these speakers has enabled us to offer them at the exceptionally low price of 30s. 6d., carriage paid. When ordering state whether light or dark oak preferred. Larger models, with 16" cone, £3.—THE DIATONIC LOUD-SPEAKER COMPANY, Kimberley Street, Wolverhampton.

Highly Sensitive Microphones for radio amplifiers, etc. See "Electrical" Column.—FREDK. ADOLPH.

Radio Instruments.—Five-Valve Cabinet Set, splendid condition, complete with valves, no batteries, £6 10s.—Below.

B.T.H. 6-volt R.K. Moving Coil Speaker, brand new, cost £9 10s., gift £7.—Below.

McMichael Five-valve Superonion Heterodyne Block Unit, perfect, as new, £4 15s.—Below.

Another Snip 1—Five-valve American "Fada" Receiver, in walnut cabinet, with 5 new P.M.6 valves, very powerful set, work any speaker, bargain £9.—200, Church Road, Willesden.

"Electric Accumulators," by Bernard E. Jones, dealing with their construction and management, with special reference to using and charging wireless accumulators. Price 1s. 8d., post free.—PERCIVAL MARSHALL & Co., 66, Farringdon Street, London, E.C.4.

"Moving Coil Loud-speaker," as described in "The Wireless World," by F. H. Haynes. This booklet gives complete constructional details and dimensional drawings for building an instrument at a moderate cost, whose output is suited to home conditions. Price 1s. 8d., post free.—PERCIVAL MARSHALL & Co., 66, Farringdon Street, London, E.C.4.



Motor Cycle Spring Forks, 7s. 6d.; Frames, 7s. 6d.; Petrol Engine, single flywheel, magneto, carburettor, 45s.; Dynamo, 12-16 volts 6-8 amps., 32s. 6d.; Switchbox with meter, 6s. 6d.; particulars, stamp.—SWIFT, Huntbridge, Mallock.

2 1/2 h.p. Ixion Motor Bike, complete with magneto, carburettor, tool-bags, spare tube, etc., ready to ride, free on rail £4.—H. A. T., Gloves Lodge, Bell Road, Sittingbourne, Kent.

Jowett Light Car, 2-seater, licensed, and running daily, £20.—Brickworks, Pildacre, Ossett.

LIGHT MACHINERY

Sales and Wants



Lathes.—Britannia, C.A.V., Drummond, Edgar, Eta, Exe, Milnes, Patrick, Wade, and all leading makes in stock.—BUCK & RYAN, 310-312, Euston Road, London.

Lathes, standard makes, easy terms; lists free.—Machinery Dept., J. G. GRAVES, LTD., Sheffield.

Milling Attachments for Lathes, Dividing Mechanisms, Combination Woodworkers. Experimental work and models to order.—WHEELER CO., LTD., Trench, Wellington, Shropshire.

You Needn't Take Risks! In 1907 we started making Chucks for M.E. readers, and, having stood the test of time, we're still going strong. We supply most leading lathe makers. Chucks sent on approval against cash.—Below.

Independent Chucks! Light model, having four reversible hardened steel jaws, square thread screws. Specially designed to screw direct on to Drummond, Britannia and other light lathes, saving overhang, and weight and expense of backplates. Price: 34" Chucks, 29s. 6d.; 41" 33s.; 6", 39s.; 7", 48s. 6d. Carriage paid. If screwed to fit lathe, 3s. 6d. extra. Larger sizes same style up to 18".—Below.

Chucks! Chucks! Self-centring Chucks, Drill Chucks, Independent Chucks. All sizes up to 30" diam. 5,000 in stock! Write us before buying elsewhere.—Below.

Three-speed Treadle Motors for driving any make of lathe. Ball-bearing Flywheels, 55s.; Plain Bearings, 45s.—STERLING CHUCK CO., Cobden Street, Bradford.

S.S.S.C. 9" Lathe, extended bed, splendid condition, £10; also 3 small Capstan Lathes, D.E. Polishing Spindle, D.E. Bench Grinder, 12" spindle, Blacksmith's Hearth and Bellows, heavy Power Bench Drilling Machine, 3-come F. & L., accept £3 10s.; new "Record" Bench Vice, 4" steel jaws, 14s.; new 5-ton Bottle Jack, with tommy, 12s. 6d.—S. HIBBERD, 17, Ash Street, Sheffield.

Special Offer!—3/16" Plated Bolts and Nuts, 1s. 9d. gross (assorted); small Drills, 1/16" to 3/4", set of 6, 1s.; 4" Files, 6 assorted, 1s. 6d.; Plated Washers, 1s. 9d. gross; list free.—WESTERN ACCESSORIES, Stapleford, Leicestershire.

Really Sound Model-maker's Lathes at prices ranging from £2 5s. to 12 guineas, all of Portass make; illustrated list free.—BRANDWOOD'S (Lathe Dept.), 2a, Thornton Road, East Sheen, S.W.14.

6" x 6-ft. S.S.S.C. Lathe, by Muir, wants change wheels and 2 skew gears, good otherwise, £7 10s.; Six-burner Primus Stove, £1 5s.; 1921 Talbot-Darracq Five-seater, £15.—FISHER, Engineer, Cuxton, Rochester.

2" Lever Scroll Chucks, backplate fitted, 15s., post free.—PINKNEY, Heanor, Nottingham.

Universal Hand Shaping Machine, tee slotted bed and front, each 12" x 12", special vice, detachable and self-acting cross-slide, swivel cot head, excellent order, £5 or offer.—NIGHTINGALE, Carey Road, Wokingham.

Portass 21" Bench Lathe, with slide-rest, lever tailstock, 30s.—18, Penypound, Abergavenny, Mon.

4" Drummond, long bed, £8 10s., new; Dynamo, 8 volts, 27s. 6d., new.—HUTCH, Toll Street, Nottingham.

4" Drummond Lathe, complete, chuck, tools, micrometer, and extra accessories.—JOHN HARMON, Atleborough Fields, Nuneaton.

One Burton Griffiths' Heavy Facing Lathe, capacity 2 ft. 3", £10; 1 Taylor Capstan Lathe, 1" bore, with 6 collets, £15; 1 Archdale Horizontal Milling Machine, 1" arbor, little used, £15; 1 Adams' Drilling Machine up to 1", £3; 1 Fortuna Hack Saw Machine, 30s.—JAS. ADAMS & SON, LTD., 105, Union Street, London, S.E.1.

Clearing Out.—Treadle Lathe, heavy flywheel, 3" centre, 20" bed, compound slide-rest, dog faceplate, numerous tools, perfect order, bargain £2.—HEGINBOTHOM, Harrietsham, Kent.

Wade Lathe and Foot Motor, Whitton S.C. chuck, faceplate and dogs, drill chuck and pad for tailstock, all in new condition, £4.—CHISHOLM, Horley, Surrey.

Hand Shaping Machine, new design, planes 4" x 4", complete machines or planed castings supplied; excellent photo, particulars, 3d. stamp s.—GEO. GOODMAN & CO., Engineers, Bristol.

Taps, Dies, Drills, Broaches, Engineers' small Tools. Bargain prices. Lists free.—MARKOVITZ, Tideswell, Buxton.

Watchmaker's Lathe, with accessories, cheap; stamp.—MORRIS, 25, Convent Gardens, Nottingham Hill.

4" Centre Drummond Bench Lathe, no driving gear, £4 10s.; also small Power Bench Drilling Machine, 3" capacity, 15s.—FLETCHER, 15, Selwyn Road, Birmingham.

3" Societe Genvoise Dead-centre Precision Bench Lathe, slide-rest, change wheels, compensated lead-screw, perfect condition, described in article Model ENGINEER, January 3, 1929, £30 or offer; deposit system.—JAMES DAVIDSON, JUNR., Auchinheath, Lanarkshire, Scotland.

Bargains.—4" Iron Leg Vices, 10s.; Horizontal Drilling or Milling Machine, slotted table, massive iron stand, 40s.; 41" Plain Lathe, 4-ft. bed, iron stand and trays, 40s.; American Bench Drilling Machine, 38s.; fine Pillar Drilling Machine, £6; Power Hack Saw Machine, £4.—ERIC FRY, Combe Road, Wotton-under-Edge, Glos.

41" Barnes' Screw-cutting Treadle Lathe, chuck, etc., flat belt, £9.—178, Camberwell Grove, S.E.5. Compound Slide-rest of special design supplied for the round-bed Drummond, Wade and Verschoyle lathes; prices, particulars, stamp.—GEO. GOODMAN & CO., Engineers, Bristol.

6" Geared Power Bench Shaper, new, 3 speeds, self-acting, bargain £8; 5" B.G. Screw-cutting Lathe, change wheels, countershaft, £9.—Below.

41" "Eta" Plain Screw-cutting Lathe, 3-ft. 6" gap bed, change wheels, countershaft. State requirements, please.—KNAPTON'S MACHINERY MART, Wade Lane, Leeds.

31" Drummond Bench Lathe, flat gap bed, back-geared, screw-cutting, S.C. chuck, and accessories, £10; good condition.—314, Mansfield Road, Nottingham.

Works Closed Down. Instrument Makers' Plant and Tools.—National Gas Engine, Lathes, Capstans, Bench Miller, Driller, Shaving Presses, Guillotine, Linisher, useful odds and ends, cheap to clear. Seen after 6 (evenings), 2 Saturdays, or Sunday mornings. London inquiries only.—LESS, 319a, Green Lanes, Manor House, N.4. (Rear 321.)

3" to 41" Back-geared Screw-cutting Bench Lathes, gap beds, from £7.—SAUNDERS, 4, Amberg Station Road, S.E.

Chucks, scroll, 21" 16s.; 31" 11; 41" 25s.—Brickworks, Pildacoe, Osselt.

Middleton.—Horizontal Milling Machine (Archdale), 22" x 81" table, back-geared, auto feeds, beautiful condition, £14 10s.; stamp, photo.

Middleton.—Universal Tool-cutter and Surface Grinder (Thompson), 28" x 5", sawing table, exceptional bargain £11 10s.

Middleton.—Best quality Bright Drawn Steel, 11/16" round, 6d. ft.; 5/16" round, 3d. ft.; 3/4" square, 41d. ft. Any length cut.

Middleton.—Clearance of best English Cast Steel Files and Rasps, 10"–16", 6s. 6d. doz.; 6"–10", 4s. 3d. doz.; best quality Turning Tools, 71d. lb., in 3-lb. lots; Carbonum Grinding Wheels, 6" x 3/4" x 1/2", 1s. 6d. each; Wood Circular Saws, 19", 21", 22" diam., 9s. 6d. each; Crocodile Shears, 6" blade, 6s. 6d. each; 8" ditto, 8s. 6d. each; all carriage extra.

Middleton.—Horizontal Milling Machine (Herbert), 18" x 7" slotted table, beautiful machine, £3 10s.; stamp, photo.—MIDDLETON & CO., Hazelwell Street, Stinchley, Birmingham.

Small Bench Lathe, suit instrument work, chucks, tools, etc., 43s.—F. N., 16, Sunninghill Road, London, S.E.13.

Brass Glass Cutters, 5 wheels, 1s. 2d. each. Send P.O.—C. R. WATSON, Church Hill, Killyleagh, Co. Down.

Screw-cutting Lathe, 5" centre, gap bed, 3" hollow mandrel, back-geared, faceplate, change gears, countershaft, 6" chuck, £9.—Below.

Timbrell & Wright 1/2" Bench Capstan, traversing cut-off, wire feed, one collet, countershaft, £5.—Below.

Timbrell & Wright Hexagon Capstan, 6" centre, traversing cut-off slide, fitted 6" chuck, countershaft, chip tray, pump, 14" hollow mandrel, £8.—Below.

Bardon & Oliver 61/2" Friction Back-geared Capstan, fitted chuck, etc., £10; Victor 41/2" S.S. and S.C. Lathe, back-geared, hollow mandrel, £12 10s.—Below.

Pillar Drilling Machine, No. 2 Morse taper, rise and fall table, £5; Two-spindle Drilling Machine, £10; Power Hack Saw, £1 10s.—Below.

Vertical Milling Machine, table 26" x 7", auto feeds, £12; Ludwig Loewe 10" High-speed Shaper, £16; Richmond Hand Milling Machine, on pedestal, 20" x 6", £10.—MICKLEBROUGH, 143, Walmer Road, North Kensington, London, W.10.

"Let Me Explain," by Archibald Williams. Most of us do not know how to explain! Try to "explain" a motor bicycle, or just your own ordinary electric light. The author has the gift of explanation, and deals with Aeroplanes, Big Guns, Cold Storage, Dredgers, Electric Motors, Escalators, Flour Mills, the Kinematograph, Mechanical Typesetting, Motor Cars, Paper-making, Snow Ploughs, Steam Engines, Steel Manufacture, Wireless Telegraphy, Wireless Telephony, Water Supply, and Wood-cutting Machinery. Just the book for the fireside! Price 8s. 3d. post free from PERCIVAL MARSHALL & CO., 66, Farringdon Street, London, E.C.4.



"Lion" Oil and Petrol Engines, complete outfits, from £12; British made; deferred terms.—LION ENGINE CO., 166a, Pentonville Road, N.1.

5 h-p. National Gas Engine, magneto ignition, £9; 4 h-p. Wilson Oil Engine, £9.—136, London Road, Mitcham.

21/2 h-p. Petrol Engine, by Madison, Derby, mounted complete on 4 wheels, excellent condition, £7.—SHEPTON, Kingscote, Cheltenham.

Who Wants a Cheap Engine? Here you are, then! 5 h-p. Blackstone, £7 10s.; Hornsby, about 4 h-p., £9; both these are in running order and will be put on rail free immediately on receipt of cheque.—Below.

Enclosed-type 11-kw. Dynamo, ball bearings, needing slight repair, £4; 12-watt Enclosed Dynamo, nearly new, £3 10s.; six Car Starter Batteries, £1 each; Beadmore Motor Cycle, less engine and gear-box, 30s.; quantity of Second-hand Wireless Parts, cheap; state wants. Wanted for cash or exchange, Lister 8 h-p. Petrol Engine.—GRINDLEY, Press, Salop.

20 Brand New Fairbanks' Morse Vertical 6 h-p. O.I. Engines, complete, but without magneto, price £5 10s. each, delivered your address.—C. DUKER & CO., Bassin Loubet, Boulogne-sur-Mer, France.

1 h-p. Hartop Horizontal "S" Type Petrol Engine, tanks, etc., nearly new, £6 10s.—Below.

11 h-p. National Type, in miniature Horizontal W.C. Petrol Engine, magneto ignition, tanks, etc., £7.—Below.

11 h-p. Horizontal W.C. Gas or Petrol Engine, balance weights, tanks, etc., £5.—KNAPTON'S MACHINERY MART, Wade Lane, Leeds.

"Engines"—(Contd.)

Here's a Bargain.—2½ h.p. Petter Oil Engine, almost new, complete with tanks, piping and exhaust box, £16; approval against cash.—Auro Electric Services, East Street, Petworth.

Send for Illustrated Lists of our S.A.V. and F.E. Type Water-cooled Petrol and Gas Engines, both two- and four-stroke types, from ½ to 1½ h.p. Prices are as low as £8 10s. for a finished 1½ h.p. Gas Engine, fitted with machine-cut skew gears, fully machined sets of parts from £5 2s. 6d.; and complete sets of rough castings, with drawings, from 52s. 6d.—FRANK HARTOP & SONS, Engineers, 28, St. Leonard's Avenue, Bedford.

3½ h.p. P. & M. Engine, with E.I.C. magneto and B. & B. carburettor, in perfect condition, 50s.; also general P. & M. Spares.—230, Westbourne Grove, Bayswater.

Horizontal Steam Engine, 3' x 4', governed, heavy cast bed, seen working, splendid finish, £4 or exchange.—HIRST, 14, Oldfield, Honley, Huddersfield.

£5 10s. Bargain.—Brand new 2½ h.p. Marconi-Douglas Stationary Engine, governed, complete tanks, accessories, ready to start.—Below.

£5.—Brand New Economic-Marconi, 3 h.p. Stationary Engine, 2 cylinders, two-stroke, governed, on bedplate, with tanks, accessories and spares.—Below.

£5.—Brand New Marconi-A.B.C. 2 h.p. Stationary Engine, complete, on bedplate, with accessories and electric starter motor.—Below.

Must Clear.—Several Chevrolet and Ford Engine Units, perfect condition, from £3.—COLEMAN, Willingale, Ongar, Essex.

1 h.p. Vertical Petrol Engine, water cooled, with tanks, magneto and carburettor, £3.—L. BODIN, 13, Fins Street, Dudley.

Complete Set Patterns and Core-boxes, 1 h.p. water-cooled valveless petrol-paraffin engine, professionally made, cost £50, with set of castings off same, £10.—18, Fern Terrace, Bradford, Yorks.

Gas Engines.—Hartop 1½ h.p., new, £5; Beauland and Perkins 1 h.p., 55s.; Horizontal ½ h.p., in parts, 30s.; Petrol Engine, 1½ h.p., twin-cylinder, 55s.; Singer 10 h.p., 4-cylinder, 65s.—AUSTIN, Churchside, Hasland, Chesterfield.

1 h.p. Petrol Engine "Jess," complete with carburettor and magneto, oil and petrol tanks, bargain 25s.; 12-volt 10-amp. C.A.V. Dynamo, suit above, 25s.—MARCHANT, Tiptree, Essex.



Read "Electricty" every week. A clearly written, well illustrated, practical trade paper. Every Thursday, 3d. Newsagents and Bookstalls.

Dynamos for workshop lighting or battery charging, latest type Marston-Billington make, 6 or 12 volts, slow running, brand new and guaranteed, 70s. each (list price £10 10s.). One month's approval allowed. Send for illustrations.—Maupe's, below.

Accumulators (Peto & Radford): 2 volts 30 amps., 8s. 6d.; 2 volts 80 amps., 10s. 9d.; Fuller, 6 volts 40 amps., 17s. 6d.; "Block" type, 18s. 9d. C.A.V., 6 volts 60 amps., 25s.—Below.

Storage Batteries, C.A.V., 6 volts 88 amps. (actual), 45s. each. All new, and sent on approval against cash.—MAUPE RUBBER CO., LTD., 58, Praed Street, W.

Charging and Demonstrating Switchboard, 1' slate, 4 ft. 2" x 1 ft. 8", iron frame, with extra 1" panel, 2 ft. 8" x 1 ft. 8", fitted three voltmeters (one moving coil) and three ammeters, reversing collecting switch, 3 D.P. switches, bus bars and automatic cut-out, with clock mount, as fitted in the M.E. workshop; connected thereto a 20-volt 40-amp.-hour Chloride Accumulator Battery, in glass-covered stand, with glass cells (wants new negatives); price £6 10s.—GARRAY, 66, Farringdon Street, London, E.C.4.

Accumulators, glass, suitable small installations; Accumulator Plates, single, groups, containers, separators.—HAYNES, near 847, Old Kent Road, S.E.15.

110-volt 50-amp. Dynamo, £10; 50-volt 20-amp. Petrol Electric Unit, £12.—136, London Road, Mitcham.

Charging Dynamo, 30 volts 10 amps., £6; 60 volts 9 amps., £8; Slate Switchboards, complete, £5; Petrol Engines to suit, £10; complete Lighting Sets supplied.—MOORE'S PRODUCTS, 32, Church Street, Oldbury.

D.C. Motors and Dynamos.—1/17th h.p. 200–250-volt Motor, £1 15s.; ½ h.p., 100–110-volt Crocker-Wheeler, no starter, £3 10s.; carriage extra.—GARRAY, 66, Farringdon Street, E.C.4.

Storage Cells (Edison's), 90 amp.-hour (actual), 10s. per cell.—Below.

50/80-volt 12-amp. Charging Dynamos, ring-oiling bearings, as new, £5 10s. each.—Below.

Petrol Electric Plant, Lister engine, Crompton dynamo, 50 volts 15 amps., £32 10s.—Below.

A.C. and D.C. Motors, from 1 h.p. upwards, perfect and cheap; all goods offered are guaranteed.—COLE, Milo Works, Milo Road, East Dulwich, S.E.22.

Electric Clocks.—Parts and Castings from SYNCHRONOME CO., LTD., 32, Clerkenwell Road, E.C.

New 200-volt ½ h.p. Motor, compound, adjustable brush rocker, double shaft extension, 35s.; 200-volt Cabinet Vacuum Cleaner, 50s.—STENT, 83, Hibbert Road, Leyton, E.17.

Bargain.—3½ h.p. D.C. Motor, (Vickers, Birmingham), new condition, 110 volts, 800 revs., pulley 6" x 4", weight 4 cwt., complete switch and starter, ring-oiler bearings, £7 or nearest offer; exchange 1" Scale Coal-fired Tank Baltic Locomotive, in running order.—TIVEY, Shop, Melbourne, Derbyshire.

Set of 27 Exide House Lighting Batteries, 50 volts, good order, £7 or nearest offer.—7, Castleton Road, Royton, Lancs.

Lalley Electric Lighting Set, 32 volts, with 16 Edison 45-amp. Accumulators, good order, £35.—Below.

Lighting and Charging Set, 2 h.p. Pelapone petrol engine, vertical, belt driving 50-volt 20-amp. dynamo on combination base-plate, switchboard complete, £16; nice order.—JOHN WHEATLEY, Chapelton, Leeds.

Guaranteed Motors.—9 h.p., 460v. D.C., 820 r.p.m., with pulley, starter and rails, £16; 1 h.p., 200/230v., 1,375 r.p.m., with pulley, £4 15s.; Motor Generator, 200/240v. A.C. input, 25/30v., 200 watts output, ball bearings, £10; ½ h.p., 200v., series wound, D.C. Motor, £1 15s.; 12v. 3½a. Ball-bearing Dynamo, £2 10s.; Rotary Transformer, 200/230v. D.C. input to 6–12v. 4a. output, ball bearings, £3 15s.; Battery Charger, 100v. A.C. input, 25/30v. 4a. D.C. output, £3 10s. All sizes of Motor Starters in stock.—QUEEN'S ENGINEERING, 60, Queen's Road, Battersea, S.W.8.

Dynamo, 8 volts 8 amps., by Lucas, ball bearings, 15s.—FLETCHER, 15, Selwyn Road, Birmingham.

Modern Type 4-pole Slow-speed Dynamos, 100 volts 8 amps., slide rails, pulley, £5 10s.; 110-volt 50-amp., £11 10s.; 110-volt 70-amp. £12; 120-volt, 850 revs., 75 amps., £17; rails and pulley: all by best makers; guaranteed condition.—ERIC FRY, Combe Road, Wotton-under-Edge, Glos.

Dynamos! Dynamos!! Dynamos!!! Staggering value. Thoroughly modern high-class ball-bearing types. Totally enclosed Shunt-wound Dynamo, 12–16 volts 10 amps., lighting 12 H.W. 16 candle-power lamps comfortably, and especially suitable for charging, etc. Exceptionally robust, generating instantly. Fitted with slide rails, and driving pulley, 35s.—Below.

We Have Only a Few of These Magnificent Generators left, and if you wish one reserved, it is essential to order early, otherwise it will be too late. Every machine cost in the vicinity of £8 to £10. Our price 35s.—UNIVERSAL MOTOR CO., James' Road, Derby.

50 Brand New Three-cylinder Air Compressors, price £5 10s. each, delivered your address.—C. DUNLOP & CO., Bassin Loubet, Boulogne-sur-Mer, France.

Electric Lamps, best non-combine makes, metal filament type, 25 volts 10 watts, 50 volts 16 to 60 watts, and 100 to 200 volts 10 to 60 watts, 1s. 4d. each.—Below.

100 to 280 Volts.—Half-watt type, 40 watts, 1s. 5d. each; 60 watts, 1s. 7d. each; 100 watts, 2s. 4d. each; Tracton, 60 watts, 1s. 9d. each; Carbons, 3 to 32 candle-power, 1s. each; 50 candle-power, 1s. 9d. each; Candle Lamps, half size, bayonet cap, 20 watts, 1s. 9d. each.—Post free from A. BROWNING, 60, Herries Street, London, W.10.

Highly Sensitive Microphones, watch shape, will pick up faint sounds, whispered words, quiet conversation from considerable distance, strongly amplify and transmit speech, music, clock chimes through loud-speaker; best microphone known for making dictaphones, deaf aid, loud-speaking telephone, public address speaker, radio amplifier, electric sound detector, experiments, each guaranteed efficient, 5s. 6d.; long connecting cord attached.—Below.

A Whisper Amplified to a Roar from 7500 loud-speaker, watch ticking amplified to the noise of hammer blows, by connecting above sensitive microphone to any valve set, through small transformer.—Below.

Microphone Transformers, 100:1 ratio, designed to ensure best possible results when using radio headphones, loud-speaker or valve set with sensitive microphone, 4s. 6d.; primary and secondary terminals fitted; diagrams of connections free; goods posted by return.—FREDK. ADOLPH, inventor of the Microphone Bar Amplifier, 27 Fitzroy Street, London, W.1.

Several Small Dynamos and Air Compressor, very cheap.—WRITE, RAWLINS, 137, Blenheim Crescent, W.11.

12-volt 8/10-amp. Car Dynamo, with cut-out, with ammeter in switchbox, etc., bargain 35s.—Below.

1 h.p. 230-volt 50-period Rayner Squirrel-cage Motor, complete, almost new, £8.—Below.

½ h.p. 240-volt D.C. Motor, good condition, 25s.—200, Church Road, Willesden.

Brand New ½ h.p. Single-phase Motors, with start and running switch, £4 5s.; 1 h.p. 400/440-volt 3-phase Motors, £4 5s.; all 7 years' guarantee; Dynamos equally cheap; state requirements, please.—KNAPTON'S MACHINERY MART, Wade Lane, Leeds.

Switchboards! Switchboards!—Let us quote you for that Switchboard, built up on best enamelled slate, to suit your requirements; first-class workmanship; at prices to suit your pocket.—Auro Electric Services, East Street, Petworth.

Austin 8 h.p. 4-cylinder Lighting Engine, £10; 1½ h.p. W.C. Two-stroke, 30s.; 32-volt 120-amp. Hart Lighting Cells, £8.—C.A.R.R., Siesta, Brigg.

Glass Cells, 15" x 11" x 7", 9 plates, £1 5s. each; Enclosed-type Shunt-wound Interpole Dynamo, ball bearings, etc., 110 volts 33-6 amps., £10.—Below.

Crossley Engine, about 5 h.p., latest type, £15, with accessories. Get details.—Brickworks, Pildacre, Ossett.

"The Cinegraph" Self-contained Electric Film Picture Projector, complete with electric belt outfit, lens, and 30 pictures, 10s., post free. Drama, Comedy, Travel.—CINESCOPE CO., 33, Brandon Street, N.W.1.

½ h.p. 220-volt A.C. Enclosed Motors, absolutely brand new, 35s. each; a splendid Model Yacht, 50s.; photograph, stamp; small D.C. Motors, guaranteed, from 15s.—22, Caddington Road, Cricklewood, N.W.2.

25-volt 10–15-amp. Petrol-Electric Charging or Lighting Plant, complete, 2 h.p. vertical water-cooled engine and all accessories, written guarantee, £8.—FORNER, Lightwater, Surrey.

Situation Vacant.

"Engineering Opportunities." This is a book you must not miss. It contains brilliant articles by Prof. A. M. Low, our Employment Supdt., etc., shows how to pass A.M.I.Mech.E., A.M.I.C.E., A.M.I.E.E., A.M.I.E.E., Matric., C. & G., G.P.O. Exams., and outlines over 60 home study courses in all branches of Engineering. Send for free copy to-day (state subject or Exam.). We alone guarantee "No Pass—No Fee."—BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY, 13, Shakespear House, Leicester Square, London.



Patents for Inventions. Trade Marks.—Advised, Handbooks and Consultations Free.—B. T. KING, Regd. Patent Agent, 140a, Queen Victoria Street, London, E.C.4. 40 years' refs. (Phone: Cent. 0682.)

"Business" (Contd.)

Patents Handbook. Advice free.—HUGHES AND YOUNG (Estd. 1829), 3, Cherry Street, Birmingham: Outer Temple, London.

Inventions Patented, Trade Marks and Designs registered at home and abroad.—GEE & Co., Patent and Trade Mark Agents (H. T. P. Gee, Mem. R.S.G.B., A.M. Inst. Rad. Eng.), 51-52, Chancery Lane, London, W.C.2 (Phone: Holborn 1525).

If You Want Reasonable Charges, precision in turning, etc., tool-making, model and experimental work, apply NORMAN GARDNER, 12, Glazbury Road, London, W.14.—Below.

Piston Rings and Model Cylinder Fitting a speciality.—NORMAN GARDNER (above).

We do Small Stampings, Pressings, etc., in all metals; large or small quantities; estimates free.—CROWN ENGINEERING Co., Wheel Yard, Peterborough.

Cabinet-Makers. Let us supply your requirements. Hardwoods, Plywood, Turnery, Mouldings, etc. Large or small quantities. Write for latest catalogue.—CORNISH TIMBER Co. (Dept. C.) Wellington Road, London, E.7.

Die Castings, Stampings, Press Tools, all machine work. Patent models made.—NEVSTAKE FITMENTS, Castle Works, Castle Road, North Finchley, N.12. (Telephone: Finchley 0238).

For Machining, Fitting, Castings and repetition work in all metals, send to LAMBERT, 41, Wendover Street, High Wycombe.

J. Lathwood, Engineers' Pattern Maker, 3, Maidenstone Road, Bowes Park, N.11.

Civil and Mechanical Engineer, at present in the Far East, returning shortly, desires partnership in a reputable business connected with light engineering, instrument making, model making, or similar work, where specialist knowledge and connection would prove advantageous.—Replies in first instance to Box 1146, MODEL ENGINEER Offices.

Advertiser has had Nineteen Years' experience building steam locos, stationary engines and models for patents. The price of work being reasonable.—Write, Box 1157, MODEL ENGINEER Offices.

"What's Wanted and Advice to Inventors." 8d., post free.—INSTITUTE PATENTEES (Dept. 9), 39, Victoria Street, London.

You Want Me; I Want You, if you have any model work, or require castings, any metal or alloy, any brazing, turning, fitting, etc., any sub-let work.—BROUGH, Engineer and Inventors' Model-maker, Cornbrook Road, Manchester.

V. Taylor, 218, Gloucester Road, West Croydon, for accurate model, experimental and instrument work. Inquiries invited.



Lathes (Drummond), 3½" and 4" or similar, purchased for cash.—BUCK & RYAN, 310-312 Euston Road, London.

Small Good-class Electrical and Mechanical Models, Chemical and Scientific Apparatus, Tools, Measuring, Meteorological and other instruments wanted.—ANDREWS, 27, New Bailey Street, Salford.

1½-2" Spark Coil Wanted, good condition.—Write, stating price, BM/EPSC, London, W.C.1.

Stuart 21s. Dynamo wanted.—State condition and price to "ENGINEER," Albany Hotel, Greyfriars Road, Reading.

Steam Engines, single or double, ½" to 4" bore. Boilers wanted; also Steam Car Motor. Send prices and description.—POTTER, 237, Avenue A, Saskatoon, Sask., Canada.

Complete Set of Mechanical Drawing Instruments wanted at reasonable price.—Particulars, Box 1158, MODEL ENGINEER Offices.

1½ h.p. Enclosed Petrol Engine wanted; must be good.—PEARSON, 7, Salkeld Road, Penrith, Cumberland.

Gardner Gas Engine Cylinder wanted, 3½" bore, with or without piston; approval only.—7, Castleton Road, Roughton, Lancs.

Siemens' Loud-speaker. State price.—ROGERS, County Club, Bromley, Kent.

11th YEAR. 12,000 SUCCESSES.

The Man Who Becomes Chief Engineer.

THE man who becomes Chief Engineer—indeed, any man who rises to a position of control and responsibility—has proved himself to be fundamentally sound. He combines in his technical equipment both the practical and theoretical. He has supplemented his practical experience with a mastery of the principles underlying his work and has constantly applied this knowledge to his practical problems.

The T.I.G.B.'s Courses are designed to furnish the maximum of practical information to assure the highest standard of proficiency and to combine effectively with practical experience to assure the most rapid advancement.

T.I.G.B. Home-Study Training is the concentrated experience of leading authorities and practical specialists in every branch of engineering, and the Training is the most authoritative and comprehensive of its kind.

State your requirements and get this

FREE

64 PAGE BOOK—

"Everything about Engineering, how to become A.M.I.Mech.E., A.M.I.E.E., etc."—the greatest book ever published on Opportunities and Modern-day Training in Engineering.



The Technological Institute of Great Britain (Established 1917)

1, Temple Bar House, London, E.C.4.

BLUE PRINTS FOR MODEL BOATS & SHIPS

Modelmakers whose preference lies in the building of model yachts, boats, liners, etc., should be interested in the "W.M." series of large-scale working blue-prints detailed below, which are obtainable at a uniform charge of 1/9 each, post free.

No.

1. R.M.M.V. "Asturias." Constructional lines for a working model.
4. Aircraft Carrier. Working drawings.
18. Yacht "Thistle" (18-footer). Hull lines and body plan.
29. Hydroplane Hull. Lines and body plan.
51. Racing Motor Boat. General arrangement, plan, and elevation.
59. Sailing Yacht (10-Rater). Sail plan of the "Vicuna."
65. Steam Trawler. Genl. arrangement drawings.
66. Sailing Yacht, "Vicuna." Hull lines and body plan.
71. Xebec Sailing Boat. General arrangement and deck plan for a model of this early type (about 1784).
73. Warship. Design for model of light cruiser type.

Please Quote No. of Drawing when ordering.

Price 1/9 each, post free, from

PERCIVAL MARSHALL & CO.

"W.M." Designs Bureau,

66, Farringdon Street, LONDON, E.C.4.

FEBRUARY ISSUE NOW ON SALE.



Price 6d. net.

The Best Magazine for Model Railway Men.

Order through your Newsagent, or send 7d. direct to: Publishing Dept., 66, Farringdon St., LONDON, E.C.4.

A SELECTION OF "PERCIVAL MARSHALL" BOOKS.

Here are a few particulars of handbooks taken at random from our bookshelves; we will gladly send any reader our complete book list post free. ANY technical book supplied by return of post.

Private House Electric Lighting. By F. H. TAYLOR, A.M.I.E.E. Describes modern methods in wiring and fitting, including a chapter on small generating plants. Price 1/6; post free 1/8.

British Oil Engines. By W. A. TOOKEY, M.I.Mech.E. A practical guide to the choice, installation, and management of modern heavy oil and paraffin engines. Tables of tests are of considerable value to designers and students. 176 pages; 23 illustrations. Price 2/6 post free 2/9.

Practical Lessons in Metal Turning. By PERCIVAL MARSHALL, C.I.Mech.E. The best instruction book on the lathe for young engineers and amateur mechanics. Thoroughly revised and up to date—220 original illustrations—210 pages. Price 3/-; post free 3/3.

Building a Lathe. By A. W. BURFORD, A.M.I.C.E. Describes the building of a lathe for plain turning of wood or metals; see the companion books "Pattern Making" and "Brass and Iron Founding"; illustrated. Price 9d.; post free 10d.

The A.B.C. of Dynamo Design. By A. H. AVERY, A.I.E.E. Clearly explains the principles of a dynamo, and how to calculate sizes and windings of machines; with numerous designs and 70 illustrations. Price 3/-; post free 3/2.

Wireless Apparatus Making. By A. V. BALLHATCHET. Dealing with the general principles governing the design, making and operation of all kinds of wireless apparatus (Receiving outfits only.) 187 pages; 138 illustrations. Price 2/6; post free 3/9.

Engineering Mathematics Simply Explained. By H. H. HARRISON. A splendid text-book for apprentices, students and engineers. Price 2/6; post free 2/8.

Useful Engineer's Constants for the Slide Rule. By J. A. BURNS. All who have to make rapid calculations will find this a most helpful book. Many worked examples are given, with methods of calculation. Price 2/-; post free 2/2.

Model Sailing Yachts. How to Build, Rig and Sail Them. A practical Handbook for Model Yachtsmen. This handbook has earned a very favourable reputation as a reliable introduction to serious model yachting. The present edition has been revised and brought thoroughly up to date, particularly in the matter of rating rules and modern designs. There is a special chapter of Notes on Sailing for Beginners, with sailing diagrams. Price 1/6; post free 1/9.

Practical Electro-Plating. By GEORGE GENTRY. Deals fully with the electro-deposition of metals; illustrated. Price 1/6; post free 1/8.

Practical Bookbinding. By W. B. PEARCE. A practical instruction book for those who desire to do their own bookbinding; illustrated. Price 1/6; post free 1/8.

Petrol Motors Simply Explained. By T. H. HAWLEY (Revised by E. W. WALFORD.) Describes the principles on which petrol motor work, and the use to which they are applied; illustrated. Price 1/6 post free 1/8.

Practical Dynamo and Motor Construction. By A. W. MARSHALL, A.M.I.E.E. A handbook of constructive details and workshop methods used in building small machines. Price 1/6; post free 1/8.

Electrical Apparatus Making. By A. V. BALLHATCHET. A splendid book for the home or school workshop, showing how to construct a useful set of apparatus for experimental and educational purposes fully illustrated. Price 3/-; post free 3/2.

More Electrical Apparatus Making. By A. V. BALLHATCHET. A companion volume to "Electrical Apparatus Making." Further example of experimental apparatus, some of a slightly advanced nature fully illustrated. Price 3/-; post free 3/2.

Maintenance and Repair of Electrical Measuring Instruments. By H. G. YARRELL. Explains the principles of operation of all types of instruments. Well illustrated. Price 2/6 post free 2/8.

The French Polishers' Handbook. By "A Practical Man." Explains how to polish from the white, how to re-gild furniture, gild and re-gild, how to polish inlaid, marqueterie, fretwork, and poker-work; together with many recipes for stains and polishes. Price 2/-; post free 2/2.

Practical Engraving on Metal. An authoritatively-written book, covering this subject and including saw-piercing, carving and inlaying; well illustrated throughout. Price 1/6 post free 1/8.

Wireless Working Hints for Beginners. A most useful book to a who wish to install a receiving set. Well illustrated. Price 1/6 post free 1/8.

How to Ride a Motor Cycle. By J. HARRISON. The contents cover the whole subject, from Learning to Ride, to Competition Riding and Family Touring. The author has been at great pains to make this handbook right up to date so as to be of the greatest service to the veriest novice; indeed, many riders of experience will obtain much valuable information from reading this book. Price 1/6; post free 1/9.

The Beginner's Guide to the Microscope. With a Section on Mounting Slides. By CHAS. E. HEATH, F.R.M.S. Written to enable an ordinary man in an ordinary way to interest himself and his friends, by conveying sufficient instruction to make him capable of seeing and showing some of the hidden wonders that are around us. It is intended to smooth the way for the absolute beginner in this fascinating study. Price 1/6; post free 1/9.

Marking-Out for Machinists.

IN all kinds of engineering and scientific production work, the accuracy of the result and the workmanlike effect are entirely dependent upon the amount of painstaking devoted to the scribing of the first few lines upon the raw material. 69 pages of helpful matter, with 34 diagrams. Price 9d.; post free, 10d.

Practical Hand-Forging.

THE contents of this book will assist the ordinary mechanic in applying some of the more simple processes of forging to his own work, thus enabling him to obtain results hitherto regarded as beyond his powers. 64 pages, with 39 diagrams. Price 9d.; post free, 10d.

Fitting and Adjusting Bearings.

THE art of Fitting Bearings is essentially one of a very practical nature, but in this little book the author has endeavoured to compress as much practical experience and information as will enable the amateur to avoid the many pitfalls which surround this particular art. Price 9d.; post free, 10d.

Also

"THE MODEL ENGINEER" SERIES OF HANDBOOKS.

A library consisting of 32 separate books covering practically all branches of model work, electrical apparatus making, and light mechanical

engineering. All these handbooks are illustrated and contain practical information. A complete list will be sent post free on request.

Price 9d. net each; post free, 10d

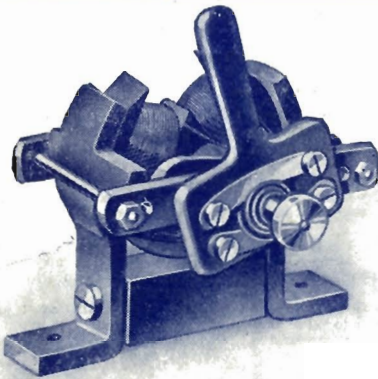


If you require information upon any subject not covered by the above books, kindly send a post card and we will advise you of the best—or most suitable—book on the subject; let us help you in your studies. When ordering any of these books, please send remittance shown any balance of postage on two or more books will be refunded.

Ask for our Book List; it's post free.

PERCIVAL MARSHALL & COMPANY,
66, Farringdon Street, LONDON, E.C.4.





The "STUART" ELECTRIC MOTOR.

Specially designed for driving boats and all small models. It is self-starting in any position, and of high efficiency due to the special magnet employed and very small air gap. Current consumption low—a 4-volt battery will drive it.

The very neat control handle has three positions for "forward," "stop," and "reverse."

PRICE **8/6** POST FREE.

Send for our
96-page Catalogue
—THE GREEN LIST.
POST **6d.** FREE

AGENT FOR VICTORIA, AUSTRALIA:

*The Meadmore Model Engineering Co., corner Boundary Rd. and Morey St., Burwood, E.18
Victoria, Australia.*

AGENT FOR U.S.A.:

Messrs. Alfred Paul & Son, 3, Ashland Street, Melrose, Mas.

STUART TURNER, Ltd., Henley-on-Thames.

"REED" MICROMETERS.

GUARANTEED ACCURATE.
(LIMITED QUANTITIES.)

Plain: 4" 14/6, 5" 15/6, 6" 18/-.
75 m/m. 13/-, 100 m/m. 14/6.
125 m/m. 15/6, 150 m/m. 18/-
Lock Nuts 1/- extra.

GEO. H. ALEXANDER MACHINERY, LTD.
Coleshill Street, BIRMINGHAM.

B2000,
for light work
PRICE
20/-



GAS HEATED Soldering Iron Stoves

For use with town's gas, or
gas and air blast, or high
pressure gas.
Made for all types of irons.

From **10/-** upwards.

A. H. Wilkes & Co.
18, Q.C., PARADISE STREET,
BIRMINGHAM.

We are exhibiting at the British
Industries Fair, Birmingham,
February 18th to March 1st.
STAND No. 15H.4.

RELIABLE BOOKS for ELECTRICAL STUDENTS.

Interesting, Practical, and Instructive.

The A.B.C. of Dynamo Design. By ALFRED H. AVERY, A.I.E.E.
This book clearly explains the principles of a dynamo, how to
calculate sizes and windings of machines, etc.; numerous designs
and 70 illustrations. The best book on this subject.

Price 3/-; post free 3/2

Electrical Apparatus Making. By A. V. BALLHATCHET. A
splendid book for the home student, or the school laboratory.
describing how to construct a useful set of apparatus for
experimental and educational purposes; fully illustrated.

Price 3/-; post free 3/2

More Electrical Apparatus Making. By the same Author. This
is a companion volume to the above, giving further examples
of experimental apparatus—some of a more advanced nature.
Fully illustrated.

Price 3/-; post free 3/2

Maintenance and Repair of Electrical Measuring Instruments. By
H. G. YARRELL. A well-written book explaining the
principles of operation of all types of measuring instruments.
Illustrated.

Price 2/6; post free 2/8

Practical Dynamo and Motor Construction. By A. W. MARSHALL
A.M.I.E.E. A practical manual describing constructive
details and workshop methods used in building small machines.
Fully illustrated.

Price 1/6; post free 1/8

Every Boy's Book of Electricity. A small book written so that
boys can understand the working of all sorts of electrical
apparatus. 48 pages, well illustrated. Price 2d.; post free 3d.

Obtainable through all newsagents,
or direct from the Publishers

PERCIVAL MARSHALL & CO.,
66, Farringdon Street, LONDON, E.C.4